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XUM

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Paralysis of the Intrinsic Muscles of the Hand in Poliomyelitis

The Use of Papier Mache Splints

By Jean Macnamara, M.D., Honorary Medical Officer to the Physiotherapy Department, Children's Hospital, Melbourne

Paralysis of the intrinsic muscles of the hands has occurred in a number of the patients affected by poliomyelitis, during recent epidemics in Victoria. It was realized that treatment should rest upon the basic principles which govern the process of recovery, in partially paralyzed muscles in general. In the earlier years, however, difficulties were encountered in the detailed application of these principles. The methods evolved have proved satisfactory in practice during the past five years; and, as the type of splints has application in diseases other than poliomyelitis, a description of the methods may be of interest. Charles Fayette Taylor[1] and Hugh Owen Thomas[2] taught seventy years ago, and Sir Robert Jones [3 4] has repeatedly stressed the fact that, in order that a partially paralyzed muscle may achieve the maximum recovery, the bones on which it acts, should be maintained in such a position that the muscle is continually relaxed. The lesions of poliomyelitis in the human are characterized by the patchy distribution of destroyed neurones and the survival of a varying percentage of their neighbors. Just as there are more glomerular units in the kidney than are often called into simultaneous action during health, so, in health, each muscle is made up of muscle fibres provided in greater numbers than are often called into simultaneous action unless demanded by maximum efforts, for each individual fibre, when it contracts, contracts to its utmost. The development of these "reserve" muscle fibres may be seen when a person takes up labour involving repeatedly maximum muscular efforts, such as milking. In untreated cases, the natural tendency of any surviving fibres to take over the work of the destroyed cells, is prevented by the functional disability added by continual stretching. If this continues, the sequence follows:

(1) Complete loss of the movement normally performed by the muscle;

(2) Wasting of the affected muscle;

(3) Contracture of the antagonistic muscles favored by continual relaxation or spared by the original lesion;

(4) Deformity.

The aim of treatment is anticipation of this deformity and its prevention by the application of splints

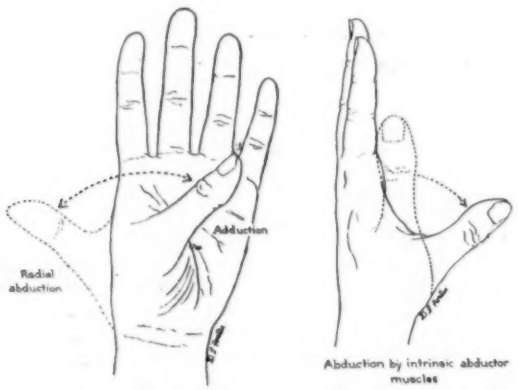
XUM

Movement	*Muscles Carrying out the Movement*	*Antagonists*
The Thumb Abduction from the plane of the palm	(1) Abductor Pollicis Brevis. (2) Flexor Pollicis Brevis—the superficial head. (3) Part of the adductor pollicis of English anatomists.	(1) First Palmar Interosseous of Henle (the so-called deep head of Flexor Pollicis Brevis.) (2) Transverse part of the adductor pollicis.
Adduction The thumb, midway between pronation and supination is swept across the palm.	(1) Adductor Pollicis Transversus (2) Adductor Pollicis Obliquus. (3) A slip passing from the osmagnum and the bases of metacarpals 2. and 3 to the ulnar sesamoid.	(1) Extensor Pollicis Brevis, which pulls the thumb to the radial side without any rotation.
Rotation	(1) Opponens Pollicis, assisted by (2) Superficial head of flexor pollicis brevis. (3) The deep muscle inserted into the radial sesamoid-part of the adductor pollicis of English anatomists. (4) Slip from Extensor Ossis Metacarpi Pollicis to abductor pollicis brevis.	Extensor Pollicis Longus which rotates the thumb so as to bring the nail to the dorsal surface and to range the thumb in the plane of the palm alongside the index.
Flexion of metacarpo-phalangeal joint	All of the thenar muscles except the opponens.	Extensor Pollicis Brevis.
Opposition	All the thenar muscles.	(1) Extensor Pollicis Longus. (2) Extensor Pollicis Brevis. (1) Extensor Pollicis Longus.
The Little Finger *Abduction* to the ulnar side at the metacarpo-phalangeal joint.	Abductor Minimi Digiti which assists the Extensor Minimi Digiti.	Fourth Palmar Interosseous. (Wood Jones nomenclature)

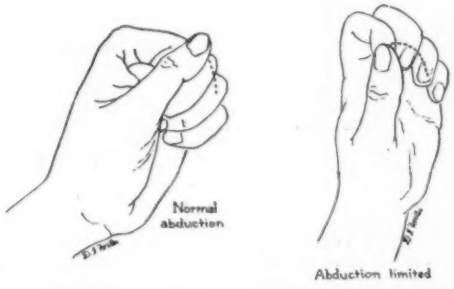
adapted to the individual requirements. As the incidence of paralysis varies in its degree and its localization in different patients, an accurate knowledge of the action of the paralyzed muscles and their antagonists is essential. For this knowledge, the teachings of Wood Jones[8], as published in his book "The Principles of Anatomy as seen in the Hand" have been of great value and will be quoted freely.

The action of the intrinsic muscles of the thumb and minimus and of their antagonists, will be summarized in table form (at top of page).

Abduction of the thumb to its radial aspect (Sketch 1) should be differentiated from abduction from the plane of the palm. (Sketch 2.) The former movement is carried out by extrinsic muscles and opposed by the intrinsic adductors.



The test for paralysis of the intrinsic abductor muscles should be carried out with the hand supine; for when the hand is prone, gravity assists their action, and thus their weakness may be masked[8]. A test suggested by Miss Stella Andrew, of Melbourne, has been useful in demonstrating involvement of the intrinsic abductors, when the other thenar muscles have escaped. The patient is asked to clench his fist, leaving the thumb outside the flexed fingers, resting against the radial aspect of the proximal phalanx of the index finger. He is shown the movement of taking the thumb from that position, around the flexed digits, until its terminal phalanx rests against the second phalanx of the medius and annularis. He is asked to carry out the movement, the hand being supine. When the intrinsic abductors are involved, the patient, in trying to carry out the movement, will extend the metacarpo-phalangeal joints, though maintaining flexion of the interphalangeal joints of the fingers. Instead of lifting the thumb bodily away from the palm, he will open the fist, slightly, to enable the thumb to slide across the nails of the index and medius.



The hollow due to the absence of the strap-like band of muscle of the abductor pollicis brevis, will be evident. The aim of splinting is maintenance of the full stretch of the web, with the thumb away from, and in front of the index finger.

OPPOSITION

This movement of the thumb involves:

(1) Abduction from the plane of the palm—by the intrinsic abductors.

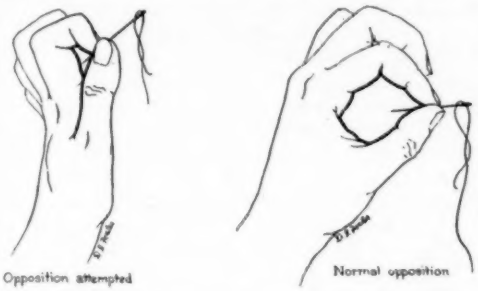
(2) Rotation, so that the pad of the terminal phalanx, not the ulnar margin comes in contact with the tips of the other digits.

(3) Flexion at the metacarpo-phalangeal joint.

(4) The action of the adductors, in sweeping the thumb across the palm.

In the paralysis of poliomyelitis, all or any of the muscles which share this function may be involved. The movement is lost or impaired, and wasting de-

velops throughout the thenar. When all the thenar muscles are paralyzed, the patient, in his attempt to oppose the thumb to the other digits, uses extrinsic muscles. The thumb, pressed close to the radial side of the index, in the plane of the palm, is extended at the metacarpo-phalangeal joint, and flexed at the interphalangeal joint. By hyper-extension of the metacarpo-phalangeal joint of the index, and flexion of its interphalangeal joints, he may be able to bring the ulnar border of the thumb, adjacent to the nail, in contact with the pad of the index finger. By further flexion of the interphalangeal joint of the thumb, he may bring its distal phalanx in contact with the pad of the medius; but he will not be able to approximate it to the annularis and minimus. The tendons of the extensor pollicis longus, extensor ossis metacarpi pollicis, extensor pollicis brevis and flexor pollicis longus may be seen and felt to contract. When viewed from the radial side, the space between the thumb and index assumes the shape of an irregular cleft, instead of the open irregular circle, made in the normal hand by the opposition of the thumb to the index finger.



By means of the extrinsic muscles, the patient may contrive to hold and use a needle or similar instrument; but the skill of the hand, and its value as an examining sense organ is greatly reduced. If this trick movement is used continually, and if, when the hand is at rest, the intrinsic muscles are continually stretched by their antagonists, the deformity, known as the "ape hand" will gradually develop. In this the palm is broadened, and the radially rotated thumb is held in line with the other digits.

When some or all of the thenar muscles are involved in poliomyelitis, their chance of recovery of surviving fibres depends upon their continued protection from stretching. The plan for appropriate splinting, should, therefore, take into cognisance the four elementary movements which together make up the complex movement of opposition. When all the muscles are involved, the splint should hold the thumb, away from the palm, rotated so that its palmar surface faces the other digits, flexed at the interphalangeal and metacarpo-phalangeal joints and across the palm of the hand.

When some of the muscles have escaped paralysis, the position may be modified. In Victoria, the intrinsic abductors and rotating muscles were involved more frequently than the adductors. In these cases, it was not necessary to secure the thumb so far across the palm; but rather to hold it away from, in front of, and facing the index finger.

MINIMUS

Unlike the thumb, the minimus cannot be rotated, but the opponens minimi digiti, the most bulky and the deepest of the hypothenar muscles, adducts the metacarpal and pulls it in a palmar direction, thus increasing the depth of the palmar cup, and making the hypothenar more prominent. When this muscle is paralyzed, the splinting applied should gather the minimus over towards the thumb.

FLEXION OF THE METACARPO-PHALANGEAL JOINTS

Extension of the interphalangeal joints.

These movements are carried out by the interosseous and lumbrical muscles with the assistance of other muscles in the first, second and fifth. In the thumb, all the thenar muscles except the opponens, carry out these movements. In the index, the flexor indicis brevis, and in the minimus, the flexor minimi digiti assist the interossei and lumbricales.

The interossei also cause lateral movements at the metacarpo-phalangeal joints. The action of the dorsal group, in abducting the second, fourth and fifth fingers from the medius, is shared by the spreading action of the long extensors; while the action of the palmar group in bringing the fingers together, is shared by the long flexors. When the interossei are paralyzed the loss of lateral movement of the fingers is not serious,—with one exception, the first dorsal interosseous. When this muscle is paralyzed, although the patient may be able to move the index away from the medius, by the extrinsic extensor, gravity, with the pull of the tendon of the extensor indicis proprius and of the second palmar interosseous, (Wood Jones' nomenclature), swings the finger to the ulnar side. In neglected cases, the laxity of the metacarpo-phalangeal joint of the index finger induces deformity. This ulnar deviation, combined with wasting in the first interosseous space, causes female patients, at least, some unhappiness; and justifies the attempt to aid recovery in the dorsal interosseous muscle, by holding the index away from the medius.

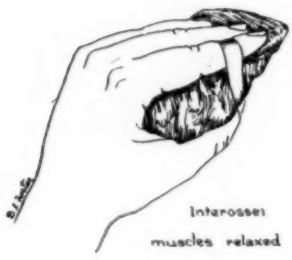
Testing for involvement of the flexors of the metacarpo-phalangeal joints should be carried out with the hand supine. Resistance should be given to the fingers, which are to be held extended at the interphalangeal joints. With the child, an easy method is to ask him to make a "flat topped table;" that is, to bend the fingers at the big joint and hold them straight. If "bumps" appear on the table, the child will try to flatten them, realizing how "milk would spill on such a bumpy table." If this can be done perfectly while the hand is mid-prone, ask him to hold the position while "you turn the table up-side down." Thus their power in holding will be tested against gravity, and when he understands the movement required, one may test against gravity, while giving resistance. After involvement of the interossei muscles, wasting develops in the interosseous spaces. The antagonists—the slips from the extensor digitorum communis, with the help of the extensor indicis proprius and of the extensor minimi digiti, in the case of the index and minimus-hyper-extend the metacarpo-phalangeal joints; while the slips from the flexar sublimis and profundus digitorum flex the inter-phalangeal joints, until the typical "claw hand" deformity has developed, and the value of the hand, both economically and aesthetically is greatly reduced. It would appear inconsistent to spend months of care preventing stretching of a paralysed deltoid, and to neglect to apply the same care to the more important problem presented by the paralysed hand below it.

SPLINTS

The various types of splints reported, of leather, aluminum or webbing, we could not modify to fulfill the requirements of the varying problems presented. While an aluminum splint or webbing band could be made to hold the thumb across the palm—the action of the adductors—abduction and rotation were not simultaneously cared for. Moreover, the metal splints which came under

our notice, tended to destroy, by pressure atrophy, the muscles they were designed to help. After some years of trial of plaster of paris, various waxes, dental impression compounds, the use of papier mâché was suggested by Miss Vera Carter of Melbourne. This material had been used in many countries during the war. Recently, reference[1] has been found to Danforth's splints of papier mâché for paralysed hands. This material provided us with a cheap, adaptable, light and comfortable form of removable splint. The recipe for the material will be given in the appendix. To make the splints: first, study the distribution of paralysis. Decide the probable deformities ahead. The finished splint should hold the bones, in the opposite position to these deformities. The splint most frequently required, is one by the hand, paralysed in all its thenar muscles, with coincident involvement of the interossei and lumbricales of the other digits. The splint should, therefore, be flat on one surface, on which the extended fingers will rest; wide enough on the radial side of that surface to secure radial abduction of the index from the medius; right angled at the level of the metacarpo-phalangeal joints to ensure their flexion; and thick enough on its radial side to hold, in full abduction from the palm, the rotated and adducted thumb.

If paralysis has involved only the thenar and hypothenar muscles, the globoid mass of pulp, placed in the hand, should be large enough to allow the index, medius and annularis to be supported in the normal position of rest, and the sides of the splint should be moulded to allow the thumb and little finger almost to approximate over the mass of pulp, as shown in sketch 8.



The pulp is moulded to the palmar surface of the hand after dusting of the hand with flour or powder. A stroking movement has been found more effective in moulding than a pinching action. The mass is grooved to form a place to rest the thumb in the desired position. To prevent radial rotation of the palmar surface of the thumb, make this groove, deeper on the radial side than on the ulnar. The position of the hand on the finished splint is maintained more easily, if the pulp be prolonged, as a tongue like process, down the groove of the life line, almost to its proximal limit.

If required quickly, the mould is placed on a powdered tin and dried in a slow oven. The shape may be adjusted, more finely, by fitting to the hand, before drying is complete. In little children, when extension of the fingers is required, it is wise to mould the splint on a small hand, and when drying has proceeded sufficiently, to adapt it to the patient's hand; for children find it an almost irrestible temptation, when extrinsic flexors are normal, to dig the fingers into the soft pulp, and so distort the shape. At the fitting, if it is necessary to relax the first dorsal interosseous muscle, a channel may be cut through the substance of the splint for the tape which will anchor the index in the optimum position.

In hot, dry climates, exposure to the sun will dry the mould. When drying is complete, any rough portions may be smoothed with a knife. After the patient has worn the splint for some days, and one is satisfied that no alterations are necessary, the splint may be coated with shellac or duco. Such splints, coated by dipping three times in a colution of shellac in spirit, have been worn for eighteen months, and have withstood accidental immersion in water.

To attach the splint to the hand, use strips of adhesive tape, half an inch wide, about eighteen inches long and covered with gauze, to prevent adhesion, except at one and a half inches at each extremity. The mould is placed in the hand in position. One end of the adhesive tape is secured to the ulnar border of the dorsal aspect of the metacarpo-phalangeal joint of the thumb.

The tape is passed over that joint and across the palmar surface of the splint to the ulnar margin of the hand, then around the dorsum of the hand and the palmar surface of the splint again, around the fingers as a bandage and finally secured by its adhesive termination. In old-standing cases, where the radial rotation of the first metacarpal by the extensor pollicis longus, is extreme, a second strip of tape may be necessary to reinforce the action of the first. If necessary, pass a third tape, non-adhesive, through the channel described, to anchor the index away from the medius. As recovery or growth occurs, it may be necessary to make another splint to prevent constriction of the affected muscles.

The pulp may be modified to any shape required; and these palmar splints may be incorporated with a cock-up splint when dorsi-flexion of the wrist is necessary. When the extrinsic extensors are paralysed, the papier mâché splint may be used to take care of the thumb, while another splint of metal or cardboard, applied to the dorsal surface, holds the wrist and fingers extended.

At night, and in cold weather, it is well to cover both hand and splint with knitted woollen covers or a fur-lined bag.

In times of epidemic, the pulp may be prepared in readiness, so that a mould may be made at the first observation of paralysis. In cases treated from the onset, the splint should be applied constantly, day and night, except for cleansing of the hand and for physiotherapy. Study of the positions assumed by paralysed hands during sleep, when splints were not applied, has impressed upon us how relentless and steady is the pull of normal antagonists, and how even at the onset the position of deformity is assumed. When both hands are affected, it is not always easy to reconcile the patient to continual splinting of the hands, especially if relative weakness of the deltoid and the triceps demands abduction of the shoulders and extension of the elbows. If one is forced to allow freedom for some part of the day, the thenar muscles, at least, should be protected during that period. It is possible to modify a glove, to hold the thumb in the optimum position while leaving the fingers free.

Detailed directions will be given in the appendix. The felt maintains the distance between the thumb and index finger, the whale bones stiffen the thumb piece, and allow the webbing or rubber strips to imitate the action of the abductors in sweeping the thumb

across the palm. In larger hands, a leather brace, moulded to a cast made from the hand, when held in the optimum position may be used instead. In these, however, unless the leather fits too firmly to be comfortable, it is more difficult to control the radial rotation of the thumb by the extensor pollicis longus. In some cases, such leather supports have been improved by the addition of an out-rigger of a strip of duraluminium—attached to the leather at the wrist and taken up past the cup of the hand, finishing in such a position that, when the distal phalanx of the thumb is held to it by a band, the thumb is rotated as though by the opponens. The modified glove has the advantage of being cooler, less conspicuous and cheaper, for a mother can do the work under supervision. Recently Cellona has been used and has proven satisfactory, the one disadvantage being that Cellona splints can be broken by a child, while the papier maché splints withstand hard treatment.

Protection of paralysed muscles from stretching by antagonists has been stressed so frequently that it may well be asked "Why make removable splints? If rest in the optimum position is all paralysed muscles require, why not apply a light plaster to the hand to hold the thumb in the optimum position?" When arrangements for carefully controlled exercises, and faithful application of removable splints cannot be made, this is the safest policy to adopt; but, in our experience, the hands which have received treatment from the onset, have achieved more recovery when splinting has been combined with physiotherapy, than when treated by splinting alone.

PHYSIOTHERAPY

The aim of physiotherapy is improvement of the circulation, and to coax any flicker of power remaining in the muscles to bring about a number of contractions within their capacity, to guide the patient, by mental concentration to send messages from his cortex to any anterior horn cells which may have survived, but are not stimulating contractions in response to a cortical message.

Radiant heat, immersion in warm saline assists the attainment of the first objective. We have used diathermy, but the results obtained did not warrant the expense. When immersed in saline in the prone position, movements of the thumb and fingers may be attempted by the patient, in trying to squeeze a soft rubber ball between their tips and in trying to pick up small objects. In water as in air, the task given to the weakened muscles should not be so hard that trick movements of unaffected muscles take place.

MUSCLE RE-EDUCATION

Muscle re-education is the most important part of the auxiliary treatment. It requires an accurate knowledge of the function of paralysed muscles and of their antagonists, if the person undertaking the work is not to be deceived by trick movements. The exercises must vary with the age of the patient, being made into interesting games for children, more purposeful movements for older people. The patient should never be allowed to forget that the manner in which he carries out the order is the important thing, not its fulfilment. For example, unless carefully watched, he will pick up a bead between thumb and index finger without making between them the normal irregular circle, substituting instead the narrow clef (see sketches 5 and 6).

He will do this because it is easier, until continued correction has made him appreciate the trick movements he must avoid. When he can easily carry out movements with the hand placed in such a position that gravity assists, the muscles are ready for the next task—movements on the horizontal plane; later, when these become easy and perfect, the muscles are ready for movements against gravity and later against resistance. When that stage has been passed, the hours of splinting may be very gradually reduced.

In all cases, which have been shepherded through the various stages of paralysis, it is wise to retain the use of splints at night for a long period, often for a year after recovery seems complete.

Appreciation of the influence of fatigue in converting a recoverable paralysis into a permanent one, and of the difficulty of estimating when recovering neuro-muscular units are fatigued by electrical stimulation, has been the reason why electrical stimulation has been omitted from the care of our cases.

The regime outlined, of splinting and physiotherapy, should be continued as long as recovery is occurring. In mild cases, recovery may be complete within the first six or twelve months. In a small proportion, after nine or twelve months care, it may be obvious that no improvement has occurred, and it may not be justifiable to continue physiotherapy, or continuous splinting any longer. In the remainder, while improvement is usually more rapid in summer than in winter, we have not observed any time limit to the process of recovery. If treatment be continued, frequently as much recovery occurs in the third year as in the second.

It is realized that, as no one can estimate the degree or extent of initial damage to the nerve cells of the cord, one cannot produce statistical evidence of the value of any method of treatment. Our experience, however, has justified the clinical impression, that, when affected by the paralyses of Poliomyelitis, as it has been manifested in Victoria since 1927, the intrinsic muscles of the hands have better prospects of recovery than many other muscles. The results from the detailed care of the hand muscles have been as good as those obtained in any other group of muscles to whose treatment the same basic principles have been applied with the same unswerving allegiance.

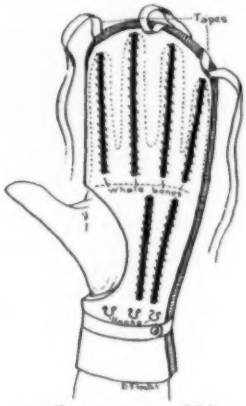
NEGLECTED CASES

Recoveries, which have occurred when neglected cases have been carefully splinted, have justified the conclusion that, in many cases, the disability of such hands is due more to muscles functionally disabled by continued stretching, than to severe initial damage to the nerve cells of the cord. The short muscles of the hand, if continuously favored by relaxation, seem to have in them the capacity to forgive the insult and recover, even after prolonged stretching. This has been noticed to the same extent, in the gluteus maximus; and is rarely seen in paralyses of the deltoid and upper abdominal muscles, which we have come to regard as sulky muscles, slow to forgive inconsiderate treatment.

A patient came for treatment six years after the onset of paralysis of the intrinsic muscles of the thumb. Because of her disability in loss of opposition it was decided to arthrodese the carpo-metacarpal articulation, and to hold the thumb by means of plaster in the optimum position for three months. The operation was performed, the plaster applied. When the plaster was removed it was found that the operation was a failure, though the action of the extensor pollicis longus and brevis was somewhat limited. A little later, it was noticed that the opponens and the flexor pollicis brevis had recovered. Since this lesson, we have learnt the wisdom, before advising any operation in such neglected cases, to give the affected muscles the opportunity of recovery, by applying a light plaster of paris spica to hold the thumb in the optimum position for a period of at least three months. If appreciable recovery has occurred in that period, conservative treatment should be continued.

A boy of five years came for treatment, three and

one-half years after the onset of paralysis of the interossei and lumbricales of the fingers. Hyper-extension of the meta-carpo-phalangeal joints and flexion of the interphalangeal joints and ulnar deviation of the index finger had been allowed to occur, and the deformity could not be fully corrected at once. A piece of Leslie's semi-compressed adhesive felt was taken, long enough to extend from above the wrist to beyond the fingers; wide enough to allow separation of the digits. The line of the felt which came opposite the metacarpo-phalangeal joints was marked on the non-adhesive surface. On this surface, four strips of whale bone were sewn longitudinally, from the distal end to this line. Two other pieces of whale bone were sewn from the proximal end to the line on the ulnar side, and the radial side of the lower half was cut out to allow space for the thumb. The adhesive surface of the felt was applied to the palmar surface of the hand and tapes, sewn to the distal extremity of the felt, were secured by hooks at the proximal end; thus applying a bow-string action inducing flexion at the metacarpo-phalangeal joint.



Non adhesive surface of felt reinforced

Hyperextension corrected by tension of tapes

This apparatus remained in position for intervals of three weeks, when, after its removal, the hands were washed and the contrivance renewed by his mother. By the steady pull into flexion, the shortened extensor communis tendons were stretched, so that papier mâché splints could be worn until recovery of the interossei muscles had occurred.

In neglected cases, economic factors may prevent the patient from giving the muscles the chance of recovery by conservative measures. In these, and in the group of cases carefully treated from the onset in which no recovery of function has occurred, it may be possible to improve the function of the hand by means of operation. When the amount of flexion and extension of the fingers is limited by co-incident involvement of the extrinsic muscles; fixation of the thumb in a good position for grasping will often allow approximation of its tip to the tips of the other fingers. This fixation may be obtained by arthrodesis of the carpo-metacarpal articulation, with or without an osteotomy of the metacarpal to bring about more ulnar rotation; or by the bone peg graft of Allen passing from the metacarpal bone of the index finger to that of the thumb. A discussion of the various tendon transplantations, suggested to improve the function of the thumb, comes outside of the scope of this paper. The operation selected depends on the tendons available, the occupation of the patient, the amount of deformity, and the function of the extrinsic muscles of the fingers.

After any tendon transplantation, the paper splints are useful to hold the thumb in the optimum position when the stage of a removable splint has been reached.

OTHER USES OF PAPIER MACHE SPLINTS FOR HANDS

In cases of multiple arthritis involving the hands, after burns and infections of the palm, such splints, even if worn only at night, are useful to anticipate deformity. In ulnar nerve lesions, it is not always wise to splint the hand continuously; but a splint will protect the paralysed muscles until nerve regeneration has taken place. It is possible to incorporate in the pulp, before drying, metal cylinders into which various appliances may be secured. A returned soldier who for two years had held his fingers tightly clenched over the flexed and adducted thumb, was referred by Sir Richard Stawell. Splints were moulded to a normal hand of the same size, held in the position of rest. Short cylinders were secured, by metal entanglements into the pulp. The patient's hands were opened, and the splints applied. Appliances were screwed into the cylinders as required —a spoon, a fork, a pencil, a hook and a tube, through which he could drink. In this way, he was enabled to feed himself and to draw, though the neurosis persisted.

APPENDIX

(1) *Paper Pulp.* The recipe used in Victoria is as follows. To make pulp for five or six splints:—Take one quire of the best unglazed milliner's tissue paper; crunch and tear up irregularly. Place in a large saucepan and cover with boiling water. If the pulp be not required at once, allow to soak over night. By means of occasional kneading, tearing and boiling, the paper becomes an even soft pulp again. Pour off the supernatant water, and squeeze the pulp to express some of the remainder. Bring the remaining water held in the pulp to a boil. In another vessel, mix eight level tablespoons of starch with enough cold water to make a thick paste. Add this paste slowly to the boiling pulp, stirring all the time. The small amount of boiling water held by the paper will swell the starch granules of the cold solution, thus binding the mass together. Stir briskly so that no lumps form, using the back of the spoon to flatten any which may appear. When all the starch has been converted, add one-half of a tube of seccotine, or similar glue, mixing well. This addition is not essential. Allow to cool and transfer the mass to butter muslin and express any excess of water. If the pulp is to be stored, add ten drops of oil of cloves, and store into sterile, air-tight jars, until required.

(2) *Modified Glove.* Take an old glove, one size larger than the patient's hand, made of soft kid, suede or strong lisle. Remove three-quarters of the fingers. Turn inside out, and sew a strip of piano or billiard table felt, about one inch wide, to the glove in the position of the web between thumb and index finger. In order to stiffen the thumb piece, sew two pieces of tape to form two tunnels, each wide enough to take a strip of whale bone one-quarter inch wide. Let these pass from the part of the glove, which will lie over the dorsal aspect of the distal portion of the proximal phalanx of the thumb to the part which will cover the base of the first metacarpal. At their distal ends, these tunnels should approximate. One should pass to the radial side and one to the ulnar side of the knuckle. Turn the glove inside out. Apply to the hand. Insert the whale bone strips to stiffen the thumb piece, though allowing flexion at the interphalangeal joint. Sew a band of tape or elastic to the radial aspect of the thumb piece at the center of the proximal phalanx, and another piece to the radial aspect of the glove over the metacarpal. Fasten these bands by hooks to eyes sewn in the dorsal surface of the ulnar border of the glove.

ACKNOWLEDGMENTS

I would acknowledge my indebtedness to Professor Wood Jones of Melbourne, for the basis of anatomy; to Sir Robert Jones of Liverpool, for the basic principle governing the recovery of partially paralysed muscles; to Sir Colin Mackenzie, of Canberra, for appreciation of the influence of gravity in testing for minor degrees of paralysis, and for his technique in muscle re-education; to the staff of the Physiotherapy Department, Children's Hospital, Melbourne, especially to Misses Vera Carter, Stella Andrew and Nellie Taylor, for their cooperation in, and criticism of, the attempts to apply the principles; and to the Honorary Medical Staff of the hospital for the privilege of treating the cases.

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Physiotherapy as an Aid in Neurosurgery

By Winchell McK. Craig, M. D., Section on Neurosurgery, The Mayo Clinic, Rochester, Minn.

Physiotherapy is unquestionably valuable in the treatment of certain neurological and neurosurgical lesions, and the most favorable results follow close coöperation between physiotherapist and neurologist or neurosurgeon.

Many neurological and neurosurgical lesions result in temporary or permanent paralysis due to interference with the conduction of the nerve impulse to a muscle or group of muscles. This interruption may be central within the brain or spinal cord, or peripheral in the nerve plexuses and nerves after they have left the spinal cord. The distinction between these two groups becomes apparent following general and neurological examinations which should be made before any form of treatment is even considered. The central type of lesion may need an intracranial or spinal operation before the diagnosis is finally established and an opinion with regard to the proper type of after-treatment can be hazarded. Likewise, the peripheral type of lesion may require frequent observation and even exposure of the nerve with anastomosis or neurolysis, before a definite diagnosis and prognosis can be made.

The nonoperative and postoperative treatment in general should be directed toward preventing overstretching of paralyzed muscles by maintaining the limbs in a suitable posture, preventing adhesions between the tendons and their sheaths and in the periarticular structures, and finally should maintain nutrition in the paralyzed areas. Suitable postures are readily attained by the use of splints but complete and continuous immobilization of certain parts of limbs should be avoided to prevent adhesions. Large joints are not so likely to become stiff during fixation, but small joints, especially those of the wrist and fingers, must be given freedom of movement, assisted by daily active or passive exercise. Nutritional treatment is highly important because the restoration of function of the muscles, or group of muscles, is greatly facilitated by having their physical condition at as high a level of nutrition as possible while the nerve impulse is being restored. Heat, as a hot bath, is a most useful aid and easily available; when trophic ulcers are present, radiant heat may be used instead. Massage, which must be regular and methodical, not only improves the tonus but removes from the whole area products of metabolism which may accumulate as a result of lack of motion and a sluggish blood supply.

Electrical stimulation of the paralyzed muscles is of value in maintaining a maximal physical condition, if it is applied at the proper time in the convalescence of the muscle or group of muscles. One of the functions of the physiotherapist, and probably the one which requires the most individual and intelligent application, is that of educating the patient with regard to function of the muscles. This has been called muscle reëducation although it is really the teaching of the patient how to make certain muscles perform the duties which another group, now disabled, has been performing. It is essential to have the patient coöperate completely and intelligently in this readjustment, as it has been observed that patients who are coöperative and interested will always achieve the best functional results.

In order to elaborate the question of physiotherapy in the treatment of neurosurgical lesions it might be well to consider lesions of peripheral nerves. For here degeneration and regeneration of the nerve, and changes in associated structure must be taken into consideration.

Besides degeneration of the nerve fibers after nerve injury. a series of associated regressive changes takes place in the muscles and periarticular tissues. If untreated, these may cause irreducible deformities and require treatment long after regeneration of the nerve fibers has been established. Surgical treatment of the nerve injury alone does not treat the degenerative changes in the associated tissues. These must be cared for by thorough physiotherapeutic and mechanical measures.

Muscles which have been deprived of innervation gradually undergo regressive changes. The longitudinal fibers which are responsible for contraction of muscles undergo a breaking up process in which many fibers disappear and are replaced by connective tissue. It has been shown experimentally that formation of muscle is fairly well established in the embryo before neuromuscular connections are made and that primitively at least. muscle tissue is apparently independent of its nerve supply. However, once the neuromuscular connections are established, the muscle fiber is completely dependent on their integrity for development, nutrition, and function. Degeneration of the nerve fiber is followed by degeneration not only of the muscle fibers, but of the motor endplate and the neuromuscular connections. Continuous overstretching of denervated muscles, as is seen when the muscle is unsupported mechanically, adds continuous work without recuperative rest periods. The clinical value of relaxation in such muscles has been proved when muscles, formerly denervated, but without power of contraction, have rapidly regained contractility with correction of overstretching and relaxation. Mechanical

treatment of nerve injuries, besides other measures, which embrace all forms of physiotherapy, remains to help maintain nutrition and mobility of the paralyzed extremities.

Probably the most essential underlying principle of massage, contrast baths, whirlpool baths, and all forms of electrical stimulation, is the increase of circulation, and aid in the removal of waste products. Improved circulation resulting from physiotherapeutic measures is of great benefit, although clinically there seems to be some evidence that the effect produced by various measures differs somewhat. For instance, a sinusoidal current is supposed to have some direct action on the metabolism of the muscles, but it has been observed that by adding massage to the application of the current the appearance and nutrition of the part affected has been greatly improved. On the other hand, it has been observed that the use of sinusoidal current in a case in which massage has been given, has been followed by great improvement in circulation. It is possible that those two forms of treatment act somewhat differently and perhaps complement each other. Massage not only improves circulation, but is of value in maintaining the range of motion in the joints and tendon sheaths, and in preventing deformity and disabling contractures of the tendons and muscles. Physiotherapeutic measures are especially indicated in the various milder forms of irritative lesions, since in these the secondary changes in the tissues are marked. It is often found, in the more severe forms, that pain is too severe to permit physiotherapeutic measures and even in some of the milder forms, contractures and deformities take place in spite of vigorous measures. The treatment of irritative nerve lesions by physiotherapeutic measures alone is now generally considered inadequate, and it is recognized that a more direct attack must be made on the nerve itself by exploration, with consideration of neurolysis or nerve suture.

There is some experimental evidence that massage does not specifically prevent the development of atrophy, but its purpose is rather to improve the circulation and mobility. Denervated muscle is prone to develop and excess of waste products, and the object of massage is to increase the circulation, thereby removing excessive waste and increasing the supply of new blood and lymph. In extreme atrophy of the paralyzed muscle, the lightest form of massage is indicated because pressure may be transmitted to the blood vessels and too vigorous massage may cause paralytic dilation, thus defeating the end sought.

Of the different forms of baths, probably contrast baths are the most effective. The extremity is placed alternately in hot and cold water, thus increasing the vasomotor tonus and circulation. Whirlpool baths have distinct advantages, inasmuch as they provide the benefits of a hot bath as well as the massage effect.

The application of electricity to denervated muscles varies according to the stage of injury, for during the time that the nerve impulses fail to reach the muscle, galvanic and not faradic current, is indicated. Galvanic current is believed to improve the condition of the muscle, both by contraction and by some direct action on its metabolism. Muscle deprived of motor endplates is inhibited by the chemical effect of its waste products, and these are removed through the increased circulation supplied by the galvanic current. This action is also true of the sinusoidal current which improves nutrition and circulation in spite of the fact that contracture of the muscle is not possible. Contracture of muscle during atrophy is not necessarily beneficial, although contracture increases the nutrition by improving the circulation and removing waste products. It is thought that those factors which increase the circulation without contracture are more desirable, since contracture entails an added expenditure of energy and an increase of waste products. This end is accomplished by massage and electricity, probably each in a different manner.

Objections to electrical baths have been made on the supposition that they may cause overaction of the sound muscles, with corresponding overstretching of the paralyzed muscles. The advisability of applying electricity to paralyzed muscles unable to respond to electricity is not questioned when nerves are regenerating. Some form of electricity is advised by most observers although the question arises as to its strength, and the time when the current should be applied. The passage of an electrical current through a young, regenerating nerve fiber may be more harmful than beneficial and to regenerating muscle may produce injurious contracture. Unfortunately, there are no experimental data dealing with this problem and therefore many authorities prefer to be conservative, waiting until regeneration is fairly well advanced before advising the application of the faradic current, since delay would not be harmful either to the muscle fibers or to the nerve.

Probably no more important factor exists in treatment during the stage of regeneration than so-called muscular reëducation. The aim of this particular phase of treatment should be to increase the range of motion, and also to reëducate or coördinate the pathways and tissues which convey such delicate impulses, as the bone, joint, tendon, and muscle sense. The function of the neuromuscular processes may be impaired seriously as a result of the distortion of the sensory or motor fibers, thus interfering with normal reflex pathways. This results in abnormal subjective impressions, and it is the function of the physiotherapist to teach the patient to so adjust and coördinate the available responses that the most efficient functional result will be obtained. This problem of reëducation is of great importance, for although the individual muscle may regain its power of contraction, its more delicate function of coördination may be seriously impaired.

The treatment of lesions of the nervous system requires primarily correct diagnosis which may necessitate examination of tissues at operation. After restorative operation, or manipulations have been done, and regeneration and restoration of function have started, then coöperative physiotherapy will achieve maximal benefit.

The Treatment of Disuse Atrophy of Joints

By Ralph K. Ghormley, M.D., Section on Orthopedic Surgery, The Mayo Clinic, Rochester, Minn.

Disuse atrophy of joints is a condition often unrecognized. Many cases have been wrongly diagnosed, particularly as tuberculosis and arthritis. In some cases amputation has been advised, and perhaps has actually been done. A certain degree of this disability exists following trauma to joints, even of moderate severity; for

example, simple traumatic synovitis or effusion into the knee joint following a mild injury. Some limitation of motion exists, and the patient "favors" the knee for several days or longer. The result is atrophy of the muscles, principally of the quadriceps muscle which may be so slight as to be almost unnoticed or it may become extreme in some instances, reaching a point at which weakness and atrophy resemble some form of paralysis.

From the mildest to the most severe forms of the condition are many degrees and stages. I have seen complete invalidism result from an atrophic joint which in time can be restored to an almost normal condition. The changes which take place involve not only the muscle but the ligaments, the bone, the cartilage of joints and the synovial membrane. The more severe degrees of this condition present rather marked roentgenographic changes which at times may simulate other conditions, but as a rule are characterized by an extreme degree of osteoporosis. This osteoporosis is sometimes punctate in appearance, although the latter condition is more often associated with actual lesions of the nerve.

The importance of atrophy is recognized when it is observed how often it is accompanied by pain. In many cases the condition is very painful. The name posttraumatic painful atrophy has been given to the condition by some authors. The pain is usually present on use, disappearing with rest, and the degree varies somewhat with the degree of atrophy. In many cases use beyond a certain limited amount brings on pain, with the result that the patient rests the joint or limb. More atrophy ensues, and on attempting to use the limb recurrence of the pain with or without effusion into the joint is even more prompt. Thus a vicious circle is established which sometimes goes on for months or even years.

The patient in these circumstances undergoes one form of treatment then another until the condition is recognized and he is properly guided toward recovery. Various forms of light treatments, vibrators, diathermy and electric treatments are used without beneficial result and the patience of the sufferer becomes sorely tried.

Some degree of atrophy always exists after fixation in plaster of paris casts, or if splints are used for any length of time. In such case, however, everyone expects such a condition to exist and the patient is told to increase gradually the use of the limb until circulation and function are restored to normal. I shall not try to explain the importance of abnormal circulation in this condition, particularly since the exact relationship between these is not known. An increased circulation is apparent, and its relationship to the atrophy is in some respects paradoxical.

The usual history is of a mild injury, often diagnosed as a sprain, with too long fixation, either with or without plaster, until the atrophic condition sets in. This condition is usually seen among patients of the more apprehensive type. The pain continues to be present on use so that the patient, whether or not encouraged to use the limb, is more likely not to use it, and the atrophy continues to establish itself. Unless the condition is recognized and correct treatment commenced, months or years of disability may ensue.

Once the condition is recognized and a diagnosis established the physician and all others engaged in treatment, particularly the physiotherapist, may have much difficulty in restoring function to the affected part. First, patients should understand that no quick remedy is available. They should know that time and their own co-operation are of the utmost importance in accomplishing cure. The treatment is based on essentially one factor, gradually increasing active function of the affected part. All other forms of treatment must be regarded as more or less useful adjuncts, but without the active use of the part a sure will not be accomplished.

Exercises must be graduated. At first only the mildest sort of muscle setting may be done without stirring up trouble in the form of pain and in some instances swelling. The active exercise should be increased only as fast as the patient's condition will tolerate it. In some cases a very sensitive joint flares up with little increase in active exercises. As development of muscle power takes place with these exercises, active movements may be commenced.

Care in outlining active movements must be exercised, as overuse will invariably produce a setback. Massage, baking and diathermy may be employed in addition to the graduated exercises, although as has been pointed out, these can only be regarded as questionable aids. After active movement of joints is well established, weight bearing may be commenced, again with the same cautious step by step increase in the amount of function allowed. Relapses will almost certainly occur which are bound to discourage the patient, and in some instances the physician, but with proper care, ultimate recovery will take place. It is rare to see such recovery complete in less than a few weeks, and more often complete recovery will not take place until several months, or a year have elapsed. It is thus wise to fortify oneself against trouble by a thorough understanding of this fact by the patient before treatment is commenced.

Some Arthritic Changes Associated With Parathyroidism*

By Robert V. Funston, M. D.

Since the parathyroid syndrome has been brought to our attention by Max Ballin and Plinn F. Morse in our own clinic, and by the excellent works of E. L. Compere at the University of Chicago and D. Hunter in his Goulstonian Lectures, we have attempted to make a survey of the arthritic cases which have come to our attention to isolate those which have fitted into the parathyroid group. Ninety-five cases of various types of arthritis, chiefly the ankylosing type were examined, twenty-six of these showed characteristic symptoms in varying degrees. The development of arthritis in the presence of a parathyroid disturbance is a common occurrence, and is frequently responsible for the first symptoms.

There is nothing definitely characteristic of parathyroid arthritis. Painful and ankylosing joints come with hypercalcemia. An interesting experiment emphasizing the effect of the parathyroid hormone on joints was brought out by Askanazy, who created hyperemia in the knee joint of an animal by an esmarch bandage, then injected a considerable quantity of parathormone into the animal. Calcification rapidly took place about the joint and ankylosis resulted. Belsgorodsky, working in Oppel's clinic, has shown that there is an increased

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blood calcium in cases of polyarthritis. Schraer also of Oppel's clinic, has shown that there is in ankylosing polyarthritis, a reduced electro-excitability of the muscles. Since this is the reverse of what is found in tetany where there is a lack of parathyroid activity, it is assumed that there is an increase of parathyroid activity in arthritis. The control of calcium metabolism by the parathyroids has been very clearly demonstrated by Collip.

Oppel believes that the differentiation between the spinal ankylosis described by Bektereff and the more generalized type described by Marie-Strumpell is in degree only. He includes both of these types in his term "ankylosing polyarthritis."

Oppel operated fifty-five cases of polyarthritis for removal of parathyroids. Of the thirty-three examined microscopically, twenty-one showed parathyroid hypertrophy. He noted that within a day or two following operation, the sensation of stiffness in the joints had begun to disappear and that there was less pain and more ease of motion. This has been the experience in our operated cases.

However, Oppel, in all but two instances, removed only one parathyroid body. Samarin, of Oppel's clinic, in summarizing the operative results in forty-nine cases, finds improvement in thirty-six.

CLINICAL DIAGNOSIS

Several of our cases were striking in their histories and in the ultimate findings and results. We have found the general appearance of the patient, his prolonged history of pain, weakness and stiffness in the joints, particularly the spine, to be the outstanding clinical symptom suggesting further investigation. The pain is usually not relieved for any considerable time by orthopedic methods.

The next most important finding is the characteristic demineralization of the spine, long bones and skull as shown by x-ray examination. Even in the moderately advanced case there is an atrophy which is in excess of the amount to be expected from disuse. The x-rays of the skull show granular changes which in the more advanced cases may even reach an appearance suggestive of Pagets disease. In the early stages the arthritic findings in the spine may be mild as compared to the muscular weakness.

Paroxysmal abdominal pains may be present. These disappear so rapidly following parathyroidectomy that they can scarcely be considered due to mechanical irritation of the nerve roots. These pains are so severe in some instances that they can only be relieved by morphine. In one or two instances cases which were later diagnosed as parathyroidism, have come to our clinic after having been discharged elsewhere as morphine addicts.

Although the determination of the calcium content of the blood and the calcium excretion in the urine is of considerable importance in further confirming the diagnosis, still the disease in this respect simulates to some extent the picture in gout. The calcium shower into the blood is apt to be paroxysmal just as the pain is. It is often necessary to repeat the calcium determination many times for a true picture of the disease. The majority of our cases have shown a blood calcium of high normal (10.2 mgs. per 100 c. c.) and occasionally in one case reached the high point of 16 mgs. per 100 c. c.

If the calcium intake is properly regulated, the urinary excretion of calcium is a more consistent index. According to Hunter as well as Compere, a normal individual on a low calcium diet excretes about 0.1 mgs. per 100 c. c. in a twenty-four hour specimen, whereas, on an average calcium diet it may reach about 0.5 mgs. per 100 c. c. In the parathyroid syndrome it may go as high as three times the normal amount.

Additional evidence of parathyroidism has been obtained through electrical stimulation of the muscle by means of the chronaximeter, which gives the optimum *closing cathodal-contracture* for the minimum time element. This is normally $\frac{0.23}{1000}$, whereas, in parathyroidism the index may be two or three times its normal height.

In the electrocardiogram reading, as shown by E. D. Spalding of Harper Hospital, Detroit, the R-T interval is shortened. This is normally 0.26 to 0.28 seconds. In parathyroidism it is 0.22 or less. The irregularity in finding the characteristic blood and urinary pictures has led in several instances to a delay in diagnosis, which was not reached until x-ray evidence had become conclusive in itself. The following case brought this to our attention:

Wm. C., age 24, reported to the dispensary May 1, 1929, complaining of stiffness and pain in the back and hips. This had gradually increased for a period of two years. During treatment his tonsils and all his teeth had been removed without improvement.

Examination showed a round shouldered individual with a marked limitation of motion and tenderness over the spine and sacroiliac joints. X-rays showed spurring of the lower lumber segments, diminution of the disc between the fourth and fifth lumbar vertebrae and obliteration of the sacroiliac joints as well as the articular facets.

No calcium determination was made until December, 1930, 19 months after admission. Three determinations showed practically a normal calcium metabolism. The basal metabolism was minus twelve.

In the meantime, he developed more severe pain, limitation of motion and muscle spasm in the left hip. A plaster spica was applied. This at first gave almost complete relief but after a few weeks had to be removed because of increasing pain. He was again admitted to the hospital in January, 1931. At that time his spine and hips had stiffened to such an extent that it was necessary for him to sleep in a sitting position. Every source of infection was investigated without any positive findings. Lumbar ganglionectomy was performed by Frederic Schreiber for relief of the pain. He was considerably improved for about three months and was able to walk several blocks on crutches without much pain. However, pain of a paroxysmal character recurred and he was readmitted to the hospital in December, 1931. At that time the blood calcium was as high as 12 mgs. and the phosphorus as low as 2.6 mgs. Chronaxea slightly above normal. X-rays then showed marked demineralization of dorsal and lumbar spine with the reduction of the size of several of the dorsal vertebrae. The arthritis had progressed. The skull had a granular appearance. Two parathyroid bodies were removed on December 16, 1931, by Dr. Ballin. These showed adenomatous changes. Within forty-eight hours after operation, motion was freer in the joints and pain was considerably relieved. The calcium gradually returned to normal. After eighteen months, x-rays show an increase in the calcium content of the spine and arrest of the progress of the arthritis.

An instance of the misappropriation of calcium was noted in this case. He developed a calcified mass in the parotid gland which was finally expressed after several attacks of swelling.

Another case, Mrs. R. M., age 57, complained of severe backache for four years, unrelieved by orthopedic treatment. X-rays showed thinning of the intervertebral discs, the ankylosing type of arthritis and general demineralization. The blood calcium ran as high as 14.6 mgs.

and phosphorus 2.95 mgs. Two adenomatous parathyroids were removed on February 9, 1931, by Dr. Ballin and almost immediate relief of pain was experienced. This has continued until the present time.

The typical case of spondylitis connected with parathyroid disease is shown in that of Mrs. R. McA., age 26. She has always been round shouldered, possibly as a result of juvenile epiphysitis, but developed severe pain and stiffening of her spine following pregnancy. She was treated by conservative orthopedic methods for several months without relief. X-rays show a mild generalized spondylitis with narrowing of the bodies of the sixth, seventh and eighth dorsal vertebrae and thinning of the intervertebral discs. Two parathyroids were removed by Dr. Ballin on May 18, 1931. Following this, there has been complete relief of backache which has continued to the present ume. Due to the severe deformity she was, within the past few months, placed on a hyperextension Bradford frame, with great improvement in the deformity. At present she is wearing a Taylor back brace and taking corrective exercises.

In several of the cases there has been a removal of part or all of the thyroid, as well as some parathyroid tissue. Since there has been a considerable amount of discussion as to the rôle of these two glands in the production of arthritis, it seems well to point out one case in our clinic in which the parathyroid syndrome manifested itself a moderately high blood calcium ankylosing arthritis of the spine and hips, and a calcification of the femoral trochanteric bursa. This patient left the clinic and went to another hospital where an adenomatous thyroid gland was removed without any improvement in symptoms. She did not get the rapid relief of pain and the sense of relaxation in the joints, which seems to be characteristic in parathyroidectomy.

CONCLUSIONS

1. The existence of arthritis in parathyroid disease is almost invariable.

2. The existence of parathyroid disease in arthritis is comparatively frequent, and may be recognized by symptoms of paroxysmal pain, usually in the spine and abdomen, deformity of the spine with x-ray evidence of demineralization.

3. The diagnosis may be substantiated by means of repeated blood and urine calcium determinations chronaxie.

4. There is almost immediate relief of pain and a feeling of relaxation in the joints following parathyroidectomy.

5. In the milder cases when it is not possible to make an absolute diagnosis, treatment by means of cod liver oil concentrate and calcium gluconate accompanied by conservative orthopedic treatment may lead to improvement and arrest of the disease, at least temporarily.

6. The operations for the removal of the parathyroids, all of which in these cases have been performed by Dr. Ballin, have not been accompanied in any instance by either tetany or shock, and can be considered sufficiently unharmful to thoroughly justify the procedure in even the milder cases.

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Principles of Early Care of the Paralysis Resulting from Acute Anterior Poliomyelitis

Edward L. Compere,* M. D., and Margaret S. Campbell

The care of the paralyzed patient during the period just following the acute stage of an attack of anterior poliomyelitis has been emphasized in textbooks and treatises, most of which were written by and for orthopaedic surgeons. Almost all of these surgeons agree that the most important consideration is protection of the involved extremities and prevention of deformities. Methods and the value of supportive measures have been debatable issues. In the hope that we might receive some valuable suggestion for the care of our own patients, a brief outline of the procedure followed in the Orthopaedic Division of the University of Chicago Clinics was sent to the chairmen of some of the larger orthopaedic services with a request for criticism of our program and discussion of procedures found helpful in their own clinical experience. Replies were received from the following orthopaedic surgeons: Dr. Fred Albee, New York, N. Y.; Dr. Willis Campbell, Memphis, Tenn.; Dr. Frank Dickson, Kansas City, Mo.; Dr. F. J. Gaenslen, Milwaukee, Wis.; Dr. Wm. Edward Gallie, Dr. R. I. Harris, Toronto, Canada; Dr. Vernon L. Hart, Ann Arbor, Mich.; Dr. M. Henderson, Rochester, Minn.; Dr. R. A. Hibbs, New York, N. Y.; Dr. Michael Hoke, Warm Springs, Ga.; Dr. Frederick C. Kidner, Detroit, Mich.; Dr. C. Leroy Lowman, Los Angeles, Calif.; Dr. Leo Mayer, New York, N. Y.; Dr. John R. Moore, Philadelphia, Pa.; Dr. Frank Ober, Dr. Robert B. Osgood, Boston, Mass.; Dr. Charles W. Peabody, Detroit, Mich.; Dr. John L. Porter, Evanston, Ill.; Dr. Robert D. Schrock, Omaha, Neb.; Dr. Arthur Steindler, Iowa City, Iowa; Dr. George Wagoner, Philadelphia, Pa.; Dr. Royal Whitman, New York, N. Y.

The procedure in the University of Chicago Clinics which was submitted for review was planned to include four periods of treatment. Each phase of the early care of the paralysis as practiced in this clinic is submitted here, together with a summary of the replies received from the above named surgeons.

UNIVERSITY OF CHICAGO CLINICS

1. Immediately after the acute illness has subsided and further spinal punctures are unlikely, a plaster of Paris cast is put on including all parts of the body which show any suggestion of involvement. This frequently includes

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a complete body and bilateral leg cast while the arms are placed in a position of abduction and external rotation. If, at the time of applying the cast, paralysis has already set in, this complete immobilization is maintained for a period of from four to six weeks.

Note: Cast is usually bivalved within a week after application and used as plaster splints or shells.

Comments

Of the twenty-two replies to the questionnaire, all were in agreement with the general principle of early protection of the weakened extremities and attempts to promote rest and relaxation. Only ten of the twenty-two stated that they used casts or plaster shells and three of the surgeons felt that any attempt to splint the limbs was useless.

The following orthopaedic surgeons stated that their initial plan of treatment coincided perfectly with this outline: Dr. Albee, Dr. Campbell, Dr. Dickson, Dr. Henderson, Dr. Hibbs, Dr. Moore, and Dr. Schrock. Some additional suggestions or variations in methods included:

Dr. Gaenslen—"While plaster cast immobilization has been frequently advised, especially the plaster bed advocated by Lange, I have not used it and doubt if there is real advantage."

Dr. Gallie—Splinting is recommended and "In some cases it is undoubtedly useful but in many it proves worthless since the deformities develop in spite of the wearing of both night and day splints."

Dr. Harris—"I do not use plaster unless the problem of fixation is such that it cannot be solved by simpler means and this is rare. Relaxation of paralyzed muscles is the aim to be striven for, not absolute fixation."

Dr. Hart—"During the tender phase, which, in our group of patients has averaged a period of four to six weeks, we remove the fixation apparatus once daily and place the child beneath warm water in the ordinary bath tub. During this phase, we do not apply massage and we do not attempt to test the degree of paralysis in the affected extremities. While under water, the child is encouraged to actively move the various joints within the limits of pain. It has been our experience that the daily warm bath tends to shorten the tender phase and aids in the prevention of contractures."

Dr. Hoke—"I have never seen the above" (initial period of immobilization) "do any good."

Dr. Kidner—"I prefer Bradford frame and plaster shells or wire splints."

Dr. Lowman—"In the first place I would suggest the immediate use of splints, either short or long legged, preferably long, with very slight slacking off at the knee, about five degrees, to give the patient comfort. If he is in a good deal of pain and there is difficulty in controlling the muscle spasm, then plaster casts can be put on and bivalved early."

Dr. Mayer—"There is one feature of treatment which I should like to recommend to you and that is the application of *balanced traction*. Plaster shells are made as supports for the lower and upper extremities. These have hinges at the knee and ankle and are so arranged that they can be suspended from a Balkan frame. Even with minimal strength in a muscle, it is possible if the limb is properly balanced to have the patient perform motion in all directions. This we find adds considerably to the rapidity of recovery."

Dr. Ober—"It is only rarely that we apply plaster casts for extensive paralysis. The application of a cast for extensive paralysis usually takes so much out of a child and increases its tenderness so much that we have always thought it was detrimental."

Dr. Osgood—"We bivalve the plaster casts as soon as they have set since we think their only purpose should be to retain the limbs in such position as to prevent deformity, but not perhaps to absolutely completely immobilize. I think the atrophying effect from a complete cast is greater than from a cast in which there is at least a little possibility of movement and the disturbance of circulation is still greater from a complete cast left on four to six weeks. It is often a comfort also in the earlier stages to be able to apply heat either by baking, hot water bottles or electric pads."

Dr. Peabody—"Personally I am very much convinced that during the sub-acute phase every effort should be made to eliminate ascending stimuli (which may travel thru motor as well as 'sensory' pathways) and nothing does this so well as heavily padded plaster, as well as conserving heat."

Dr. Porter—"This is the stage when nursing care and splinting are most important, and mild, gentle massage may be begun. It is during this early stage that two things must be borne in mind—the danger of fatigue and of contractures."

Dr. Steindler—"Casts are rarely applied during the acute and sub-acute stage. Recumbency in involvement of the lower extremities starts, according to severity, from six weeks to four to six months."

Dr. Wagoner—"The affected part or parts are immobilized by plaster shells, not casts, with the affected muscles in the position of maximum relaxation. The use of splints or shells are found to be better than a solid or circular cast as they permit more careful watching of the skin. At this period external heat is constantly maintained through the medium of a cradle illuminated with electric bulbs, preferably those with carbon filaments."

Dr. Whitman—"It would appear that fixation of the spine during the inflammatory stage might be indicated since movements of the trunk often cause pain."

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2. Physiotherapy is started. As long as there is persistent cutaneous "stroke tenderness" this treatment is confined to warm salt baths. The patient is allowed to move about under the water (observations can be made as to the muscle power) but muscle reeducation with definite exercises is not begun until cutaneous tenderness disappears.

Comments

Complete agreement with no additional suggestions or changes in procedure: Dr. Albee, Dr. Campbell, Dr. Dickson, Dr. Gaenslen, Dr. Henderson, Dr. Hibbs, Dr. Kidner, Dr. Mayer, Dr. Moore, Dr. Osgood, Dr. Peabody, and Dr. Schrock. The following were additional suggestions made by the ones indicated:

Dr. Gallie—"My general impression is that massage is useless and that prolonged and expensive treatment in the form of muscle reeducation, exercises in salt water and so on ends up with about the same result as if patient had never been treated at all."

Dr. Harris—"Though I use physiotherapy, I am not greatly impressed with its value. Relaxation of the paralyzed muscles is the most important form of treatment by long odds."

Dr. Lowman—"During the first week we make a very careful test of all the muscles to determine the extent of involvement, check the kidney condition, which in many cases shows nephritis, and commence physiotherapy, the type and amount being determined by these findings. Of late years, when the case is a mild one, we have been starting them in the new under water gymnasium for pool treatments as early as the middle of the 4th week. Probably a high percentage of the cases are started in the 5th week."

"We consider the skin tenderness and muscle soreness as a guide and always make an effort not to produce any pain, depending upon the patient's voluntary efforts for the movements."

Dr. Ober—No physiotherapy is started until all the tenderness has disappeared, and that means deep tenderness, and the best test for deep tenderness, in my experience, is passive straight leg raising. During the tender stage patients are put in warm baths and allowed to move as much as possible without any assistance.

Dr. Steindler—"Physiotherapy and under water muscle training is started with the disappearance of the sensory symptoms, two weeks to two months after onset; same is true of muscle reeducation."

Dr. Wagner—"Approximately three weeks following the onset of the disease the patient is started on daily hydrotherapeutical treatments consisting of immersion in hot salt water of a temperature approximating that of the body and of specific gravity equal to that of sea water. Neither active nor passive motion is permitted at this time; the duration of immersion is gradually increased from five minutes to an hour. After the disappearance of cutaneous tenderness, gradual passive motion is instituted. Following the daily baths the affected parts are replaced in their shells or splints and the external heat is maintained."

Dr. Whitman—"I think massage and exercise may be deferred until the stroke tenderness has disappeared."

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3. Muscle reeducation is given at first under water with light massage after the bath. This is very carefully supervised and every precaution is taken not to fatigue any muscle group. During this period the affected extremity is supported either in plaster shells or metal splints and the patient is kept upon a Bradford frame. The apparatus should be removed for a period each day and the patient's position changed, so that full range of joint motion may be maintained.

Comment

The following replies were in complete agreement and suggested no additions or changes in procedure: Dr. Albee, Dr. Campbell, Dr. Dickson, Dr. Henderson, Dr. Hibbs, Dr. Hoke, Dr. Kidner, Dr. Mayer, Dr. Moore, Dr. Osgood, Dr. Peabody, Dr. Schrock (emphasized that they must be comfortably splinted), Dr. Wagoner. Additional suggestions were made as follows:

Dr. Gaenslen—"I would not favor the Bradford frame as a proper mattress is more comfortable and allows the slight shifts in position which, I am sure, contribute to comfort more than unusual convexity of the frame."

Dr. Harris—"I concur in this though I do not think under water exercises very important except for the psychic effect upon the patient and parents."

Dr. Lowman—"It has been our experience that the patient is quite drowsy after a period in the warm water, and I believe that in most instances if the patient can take advantage of this relaxation and have a period of rest and sleep following such a treatment it is of much more benefit than the massage. If such a treatment is given as a heat treatment preliminary to muscle reeducation, that is a different thing, but in the early cases, I feel that it would be just as well to be quickly dried off and allowed to sleep for an hour."

Dr. Ober—"Until the disappearance of deep tenderness, patients at the Children's Hospital are put in the tank and allowed to move themselves."

Dr. Steindler—"Muscle reeducation both under water and on plinth; initial care should be exercised; splinting must be rigorously maintained, outside of treatment periods."

Dr. Whitman—"The prevention of deformity is of far greater importance than exercise."

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4. Muscle reeducation is begun from two to three months after the onset of the disease. When deep tenderness has disappeared, the program of exercises can be given alternately on a table and in the water, gradually increasing the treatment in accordance with the patient's tolerance. The massage can then be somewhat deeper than at the beginning. This treatment is continued as long as there is evidence of improvement, usually from one to three years.

The following replies were in complete agreement with the outline of the fourth phase of treatment: Dr. Albee, Dr. Campbell, Dr. Dickson, Dr. Gaenslen, Dr. Henderson, Dr. Hibbs, Dr. Hoke, Dr. Mayer, Dr. Moore, Dr. Osgood, Dr. Schrock, Dr. Steindler, Dr. Wagoner. The additional suggestions or variations in method included:

Dr. Gallie—"When the stage of tenderness is over we allow the patients to start in to use their muscles as much as they will."

Dr. Kidner—"I agree in general but feel that the first section is unnecessarily rigid."

Dr. Lowman—"We have concluded, after many years of experience, that the second six weeks of convalescence is the most vital part of the whole treatment period. It is during this time when atrophy from disuse sets in in the trunk muscles, particularly. The inherent objection to muscle action produced by pain and muscle spasm undoubtedly assists in this process of atrophy. It is during this time that a knee, unless absolutely controlled, tends to show the early aspects of stretch palsy, which would be aggravated by the full joint range just spoken of."

Dr. Ober—"There is no set time at which muscle reeducation can be commenced. If the deep tenderness lasts for six or eight months, muscle reeducation is not instituted until after that has entirely disappeared. The water exercises are better for those patients who are severely paralyzed. Those with mild paralysis do not need to go in water at all. No massage whatever is given during tenderness. Improvement continues indefinitely. I have had a shoulder deltoid come back five years after the onset of the paralysis."

Dr. Osgood—"We occasionally begin some form of muscle reeducation before all cutaneous tenderness disappears but not in the region where the cutaneous tenderness exists; usually not in the same limb where the cutaneous tenderness exists. We are often able, therefore, to begin muscle reeducation at the end of a month, and we do not always delay it over the two or three months that you suggest. Each case must be a law unto itself, of course."

Dr. Steindler—"Muscle reeducational training is started about the same time as exercises are graded; also massage, until no further traces of improvement."

Dr. Wagoner—"With the disappearance of 'deep pain,' muscle education is started along the manner outlined by you. Usually about four months after the onset of the disease we are able to fit the individual with braces and make him ambulatory, unless, of course, the paralysis is too extensive. The use of electricity in muscle reeducation has been abandoned."

Dr. Whitman—"I am inclined to think that voluntary use of protected limbs is more important in the regeneration process than muscle training. This is important chiefly because it keeps the patient under constant ob-

servation and if it does not widen to much expense of time and money it may be advisable."

Several of the orthopaedic surgeons to whom this outline was submitted added additional information in discussing the length of time after the onset of acute poliomyelitis with involvement of the lower extremities weight bearing was permitted. There was almost uniform agreement that this should be deferred until several months had elapsed.

Dr. Campbell—"You did not mention just when you begin active function, as weight-bearing and active use of the upper extremities without support. We usually do not begin any weight-bearing until after the elapse of six months time, and then, of course, with the proper apparatus, which should be as light and as little as possible. In the upper extremity, we do not leave off support until the individual can actively use the parts to some extent; for instance, the shoulder should be abducted by voluntary movement to about 90°."

Dr. Dickson—"We generally allow weight bearing at the end of three months and prefer braces at this time to rigid supports, but otherwise I have nothing to add to what you do."

Dr. Harris—"You make no mention of the important problem of when weight bearing should be permitted and what safeguards are necessary to prevent or minimize deformities. I think this much more important than physiotherapy."

Dr. Peabody—"There may be some advantage in determining as early as possible the probable major residuals, and adapting fixation to put the weaker groups in maximum relaxation. Thus in lower extremity it may be preferable in the particular case to put the foot in equinus and the knee in flexion or the hip in abduction."

Dr. Wagoner—"Approximately eighteen months following the onset of the disease preliminary operative procedures are instituted. These chiefly are along the line of stabilizations and muscle and tendon transplants. It is interesting to note that we are now successfully performing stabilization operations *on children from four years of age up*. We have not succeeded, however, in obtaining satisfactory results in arthrodeses of shoulder joints in children under fourteen years of age; this constitutes, probably, the only exception to the early use of fusion or arthrodesis operations."

A study of the replies and criticisms received has been a great help to us and has given us more confidnce in handling these patients.

History of Care of Crippled and Deformed Children*

By Carl C. Chatterton, M.D.

The care of handicapped children is one of the interesting pages of history and may be divided into five stages.

The Spartan mother, knowing her deformed child would become a care upon the community and a poor soldier, exposed the child to the elements. Roman law allowed the father to destroy his unfortunate crippled child in any manner he saw fit.

Destruction was the universal method of care of the crippled child 2000 years ago.

The first recorded provision for the care of the crippled was by the Romans who, under Pope Gregory, A.D. 590, included them in his provisions of infirm and destitute to be supported by public funds. As a rule, however, medieval cripples and particularly crippled children were cruelly exploited for purposes of amusement. The courts of Europe were constantly entertained by deformed jesters and fools, and in Italy, Roman beggars made slaves of crippled children to exhibit their deformities on public roadways to gain the sympathies of pedestrians. Frequently these men would actually maim children or increase their infirmity that the appeal to sympathy might be more effective and the profits greater.

Toleration was the care given in medieval times and a few individuals of that age, in spite of great physical handicaps, are famous in art and literature today.

In England, in 1600, during Queen Elizabeth's reign, we find the first record of asylum care. The first poor relief act included cripples among those offered asylum care. Even in this age, however, we find little evidence in history that suggests humanitarian kindness toward crippled children. Martin Luther advised that a rachitic baby be thrown into the river.

The beginning of real treatment and education is first noted nearly 300 years later with the opening of a school and home in Munich by Johan Nepimak.

This movement rapidly spread throughout Germany, France, England, Switzerland and Italy.

In 1872 the first effort toward industrial education of crippled children was instituted by Pastor Hans Knudson, who founded an industrial school in Copenhagen, Denmark.

In the United States the hospital for the ruptured and crippled was opened in New York City in 1863. In 1866 the New York Orthopedic Hospital and Dispensary entered upon the same work. In Philadelphia, in 1884, the first American home to care for crippled children was established. In 1893 the Pioneer School for crippled children was established to make the cripples of Boston self-supporting.

The movement in the care for crippled children in the United States has made more progress in the last 10 years. The marked increase in the interest for the care of crippled children has been due to legislation and to national and local social agencies.

First Legislation in the United States

Early in the fall of 1896, at Mankato, Minnesota, a group of charity workers, adults and physicians, assembled in open meeting of the Minnesota conference of Charities and Corrections, were astonished to find themselves confronted by a slender crippled girl, Jessie Haskins, pleading for the support of that body toward the erection of a state hospital for crippled children.

Her address was followed by a paper, "The Duty of the State, to the Crippled Child" by the late Arthur Gillette.

Although the idea was new, untiring effort secured a hearing at the next session of the Minnesota Legislature. When the politicians met in April, the crippled girl and her professional friend once again delivered their pleas. The legislators, one after another, arose

*Abstract of considerable portion of this article was obtained from "Care, Cure and Education of the Crippled Child" by Howard Edward Abt.

and signified their willingness to a new and untried scheme, and gave their approval of the first legislative act in the United States to provide education and treatment for crippled and deformed children.

Other states were soon to follow, and now there are eight states with large central hospitals and more than half of the states in the Union have made some provision for this purpose. Agitation in the remaining states is gaining rapidly, and we believe shortly that every state in the United States will soon be giving some aid to its cripples.

SOCIAL AGENCIES

Social agencies have exerted as much, or even more good, in the care of crippled children as that obtained through legislation.

1. The various branches: International societies, social and fraternal. The Shrine movement is without parallel in history.

The Nobles of the Imperial Shrine, through a Board of Trustees, now operate 9 hospitals in the United States, one in Canada. Several small units are operating in general hospitals in areas in which orthopedic hospitals have not been built. A movable unit operates in the Hawaiian Islands.

In addition to institutions operated by the Central Committee, Hella Temple of Dallas maintains a hospital, Korsair Temple at Louisville, a convalescent home; Chymia Temple at Memphis has erected in addition to the Children's Hospital a school operated by the King's Daughters Circle.

Scottish Rite Masons of Atlanta operate a Scottish Rite hospital for crippled children. This was the first Masonic institution in existence and opened in 1915.

Kiwanis Clubs report 145 of their chapters interested in the physically defective, and this work ranges from isolated case work, to endowment of orthopedic wards or supporting a central orthopedic hospital as 60% of the Kiwanis Clubs of Indiana are doing.

The Elks are especially active in New Jersey and in other states especially in a co-operative way, assisting established institutions, supplying nurses, maintaining clinics, and surveys.

The Rotary Club, the Lions, King's Daughters, Exchange Clubs, Co-operative Club, Masonic Women, Loyal Order of Moose and other national organizations have as a part of the program aid to the under-privileged child.

National organizations, whose programs include aiding crippled children in various ways, include the Russell Sage Foundation, Rockefeller Foundation, the American Red Cross, the Salvation Army, American Child Health Association, American Orthopedic Association, American Medical Association, National Welfare Association, Department of Health at Washington, D. C., National Tuberculosis Association, and many others.

Locally and individually the work of our own late Honorable Michael Dowling is known internationally. His enthusiasm and accomplishments were wonderful aids in cheering and encouraging many a maimed soldier in the late War. Almost two years of his time was given to the Reconstruction Camps of the British Isles, as well as many months in various centers in our own country.

The enthusiasm of the Honorable William H. Eustis, giving his large fortune for grounds for a school and establishment of a special hospital for children in Minnesota deserves more than passing comment.

A directory for the care of crippled children in the United States would include 40 special associations, 98 orthopedic and general hospitals with orthopedic wards, 45 general hospitals with limited orthopedic capacity, 45 convalescent homes, 15 summer camps, 18 custodial institutions, 87 special state and city public schools and private day schools, 40 general tuberculosis sanatoria with some provision for crippled children.

The greater number of these institutions are in the eastern and northern portions of the United States. There is plenty of room for many institutions, especially in the south and west where very little attention, until the last few years, has been given to the crippled child.

Lowry Medical Arts Building, St. Paul, Minn.

Educational Orthopaedics in the Public Schools

Presented by John E. Toye, M.D., F.A.C.S., before the New Jersey Chapter of the American Physiotherapy Association on Nov. 14, 1932

While corrective gymnastics are of comparatively recent development in public school work as a major subject, there is nothing wholly new about it. Correction of deformities by special exercises of a postural nature is very old. One of your members, Miss Williams, informs me that she has found evidence to show that it was known as early at least as 3000 B. C.

But in more recent years it has developed a great deal and has become a most valuable adjunct to the regular gymnasium work in the schools.

Obviously, since the classes in the gymnasiums are made up of, and the work prescribed for, the average child, there must be many who cannot do the work or cannot benefit from it to any great degree. A child may have a weak heart which will bar him from the vigorous work in the regular gym. Or he may have a hernia,—some pulmonary disease, or some active crippling deformity as a partially healed tuberculous joint or a recent operation—a recent fracture or a great variety of conditions, any one of which would make the very active work of the regular gymnasium out of the question.

Again, a child may have a remediable deformity which would not prevent his doing regular gym work, but such that he would still be deformed after the gym work was finished. He would develop muscle but not improve his form.

So the need is very great and real, as is evidenced by the fact that we have about 2,500 pupils taking corrective work in the Newark school system and at that we feel that we have but a part of them and that many more will eventually come under the corrective workers.

There are many conditions that we find are subject for corrective gym work but perhaps the greatest number of pupils have simply poor posture.

Poor posture comes from a great variety of conditions but is very largely amenable to correction. Its cause may simply be a matter of carelessness. Or it may be due to poor nutrition—rickets—general marasmus, or it may be due to some deformity.

In the careless posture the problem is generally very simple and not a long process. In those in whom a nutritional defect is present like rickets, marasmus or simple under-nourishment, the situation becomes more complicated and other factors and measures have to be considered.

In those with some malformation there is still an entirely different problem and one which must be first taken care of by the orthopaedist as a rule, before any work may be done by the corrective teacher and then only at his request or under his direction.

And here I may say that we do not intend to allow the practice of medicine in the school work. If and when the child needs medical or surgical care, he is referred to the family physician, or if there is none, to the nearest clinic to his home where he may get adequate treatment for his condition. This only when we have become satisfied that the family cannot afford a private physician. This is one of the reasons why we do not advocate physiotherapy in the public schools. It is better done at hospitals or at the physician's office. Many of our pupils are under the care of competent specialists and our work is done under their direction or with their consent.

Next in importance in our classes are the scolioses and there are a great many of them. The majority of them are very mild, especially in the younger group of pupils, but many are very bad in the older group of those who have had infantile paralysis. And here the results will depend very largely on the cause. By far the greater number are the aftermath of infantile paralysis and these vary infinitely in degree depending upon the time it has been present and the degree of paralysis. The older and more severe cases are not curable. Indeed I am almost compelled to say that they derive little or no benefit from the work so far as correction of the deformity is concerned. However, they cannot take the work in regular gym and must have some exercise. This exercise can be best given by one who is trained in the work and therefore they are sent to the corrective teacher.

The milder cases in the younger pupils improve a great deal—in fact become completely corrected and are discharged to regular gym after a longer or shorter period. Our results in these cases are most gratifying.

In cases, however, which are of long standing and in which the condition has become more or less fixed with more or less deformity in one or more vertebrae, obviously correction cannot be obtained. Something may be done to prevent increase in the deformity and to cover it up more or less by posture but no lessening of the curves is possible.

Again there is the scoliosis caused by a short leg. This corrects at once by raising the shoe and no correction can be expected without doing this. But when this is done no further attention is required from the corrective teacher.

There are post-infantile paralysis cases that make up a great majority of the cases in the School for Crippled Children and also in other schools. So far as is possible these cases are sent to the School for Crippled Children, but many, especially in the higher grades, must go to regular schools.

The work done on these children is invaluable. It is all supervised by a trained orthopaedist who has full sway. The workers are especially fitted for this work and accomplish marvelous results.

Then there is the birth palsy or Erb's Palsy with which we find it possible to deal effectively up to a certain point. Much improvement is made in these cases within given limits, but not one gets wholly well. Still these children obviously cannot work in regular gym and certainly need something.

Then there are the many flat feet. Almost I believe that all children have flat feet. Some improve very much—many not at all and there are all grades between. This is not the fault of the workers, however, nor of the system. It is because some are congenital and others have progressed so far that correction is not possible by any method except surgery. Still others will not cooperate and others cannot get, for one reason or another, proper shoes. Many children appear wearing foot plates of more or less value and many with good shoes and other evidence that something has been done to improve them. But there are a great many who cannot buy shoes that are of any value but on the contrary come in wearing shoes that are increasing the condition with every step. The ordinary sneaker has nothing to commend it from the viewpoint of a good shoe but everything to condemn it.

Our system is rather definitely organized and works out something like this:

With myself at the head there is next the supervisor of the teachers and the work. I direct the policy of the department subject to the approval of the head of the Department of Medical Education. I also examine all the pupils who are considered subjects for corrective work and pass on them—as to whether they shall have it or what they shall have. There are many questions naturally that have to be decided and these come under my end of the work.

The supervisor takes care of the personnel of the department and assigns the work and time. This is considerable of a contract but it is well taken care of and the work goes on very satisfactorily. There is, naturally, considerable detail in this job, and it is not always easy to work out.

The corrective work in the School for Crippled Children comes under our supervision and there we have a very active and efficient group of workers. They are under the same supervisor of teachers, but the examinations of the children are done by a trained orthopaedist who prescribes and virtually has full charge of the work. He has been doing this work for many years and is one of the best qualified men for his work that I know of. He also has the opportunity to talk with the parents about the cases and is able to follow this work through the operative stage in a great many cases because, besides having this work, he also has an extremely large private practice and probably three out of five of the children have come under his care at some time or another. My active work at the School for Crippled Children is not arduous and is largely a matter of deciding the policies and upholding the doctors' hands.

Once a week I have as many children as we can handle brought to the clinic rooms at the Board of Education building and examine them there. Most of the children we are able to take care of here, but there are a certain number who will not come, for one reason or another. Some cannot get slips signed for examination and others cannot get any kind of cooperation at home. There are also the occasional pupils whose modesty will not allow them to be sufficiently undressed for an adequate examination. So in order to cover the ground fully it is necessary to get out to the schools also. However, we will change this in time and we plan to have all examinations made at the clinic.

It is my intention to get around to as many of the schools as is possible during the year and keep in touch with the work and the workers. This is necessary in order to be in a position to decide on questions of policy and effectiveness of the personnel although this latter is left largely to the supervisor.

This gives you something of an outline of the work

as we are carrying it on here in Newark. We feel that the work is most essential and extremely valuable. We are showing results that justify the expenditure of the money and as time goes on I am fully convinced that we will produce even better results.

Our plans for the future are rather definitely decided so far as policy is concerned. We feel that there is much more benefit to be derived from work in the younger grades than in those in the higher grades. During the past year we have taken a series of photographs of the cases both before and after treatment. We think we have something rather definite and concrete to show that the work is better done in the younger pupils. Naturally we cannot begin too young and also there are some who will work and cooperate younger than others.

We have found, however, that at about six or seven is as early as work can be done effectively. In this age group the corrections progress very rapidly and we feel gratified with it. There remains to learn just how long they will hold their correction but there is no reason why it should not hold. There will be a check-up twice a year on these cases to determine just how much they relapse. This will determine the future policy of the corrective gym work in the Newark Public Schools.

February 8, 1933.

DISCUSSION OF DR. JOHN E. TOYE'S PAPER ON ORTHOPEDICS IN THE SCHOOLS, NEWARK, N. J., BY FLORENCE A. MEYER, ASSISTANT SUPERVISOR OF PHYSICAL EDUCATION, IN CHARGE OF ORTHOPEDIC AND SPECIAL CLASSES

The work in our elementary and high schools is of two kinds:

1—With postural cases, flat or weak feet cases, slight paralysis, and those who are unable to participate in regular gymnasium exercises. These children are able to attend regular school and are only slightly handicapped. The largest percentage of posture defects are functional. The teachers are physical educators with additional special training in orthopedic or corrective gymnastics, and some clinical, as well as general physical education teaching experience.

2—With orthopedic cases. These are the children who attend a special school for those who are physically handicapped to the extent of needing transportation to and from school, and very special individual exercise. The teachers for these children have a general physical education training with teaching experience, and special orthopedic and physiotherapy training, with a considerable clinical practice.

Our work is strictly educational. The children are shown what their defects are and taught how to overcome them or improve the condition. This is based on an understanding of body mechanics and a development of muscle tone along with a kinesthetic sense of control. In some cases it is a matter of breaking up faulty habits and forming new habits. With others a longer training in coordinations is necessary. With many of the cripples it is necessary to teach them to walk or to improve their gait. Similar training may be necessary in the use of the arms and hands. With still others, such as cardiac and post-operative cases, it is necessary to teach the child what capacity he has for physical activity, when and how to limit it, and carefully train him to increase this capacity if possible.

The foot training is done through strengthening foot muscles, limbering up the inflexible feet, and teaching the correct use of the foot. A great deal of attention is given to having the child wear the proper shoe for his condition.

Hand in hand with this training, which is truly *physical education,* we try to help the child to check on all his general health habits. With most there is definite lack of healthy living, noticeably in their habits of sleeping, eating or exercise and fresh air. Usually all three are sadly in need of improvement.

Another important factor is the emotional state of the child, and in this too, we try to help him. Difficult periods of readjustment to school life in its various stages, or rapid growth and physical development, frequently, if not always, affect the child's postural habits. We have had success in befriending the child through individual contact, and helping him to adjust himself emotionally, while the physical posture training goes on. The more complicated behavior problems such as extreme nervousness, or maladjustment in the school or home, are referred to the Child Guidance Department which handles such cases.

In all our work we try to get the cooperation of the parents. They are invited to be present at the physical examination when the condition of the child is explained to them and a course of training is laid out. From time to time suggestions are made to the parents, or they themselves may come to us for advice. The cooperation of the parents is, of course, a great help to us in bringing about improvement as well as an encouragement.

We have made a few observations in the course of the last ten years, namely, scoliosis seems to be decreasing. With the exception of a few marked structural cases, which usually come to us from other schools, there are mostly instances of very slight functional scoliosis, if any. On the other hand the general fatigue posture, and debutant slouch seem to be much more general, which often leads the uninitiated to remark that "posture is worse than ever." In a sense this is true, but we must remember that the forced, artificial and exaggerated posture is no longer in vogue and little, if any, standards have been offered the child in its stead. We are now trying to teach the mechanics of a well balanced posture, and ways of attaining it.

Flat or pronated feet are very common, almost general. Foot strengthening, correct use of the foot, and proper shoes usually correct a condition of pain.

The Speech Problems of the Spastic

By W. B. Yeager, Jr.

Before considering forms of speech therapy used with spastics, it will be advisable to discuss the general characteristics and pathology of spasticity, as they affect speech.

Whatever its cause, the spastic condition with which the speech teacher should be most concerned is the end result of the disease. After the active destructive agent has done its work, and natural repairs have been made, the spasticity lingers as one of the chronic after-effects.

In the diagnosis of spasticity as a cause of speech de-

fects it should be remembered that the diagnosis is to be made not on the basis of a definite symptom-picture, but rather on the basis of a significant number of symptoms, no one of which can indicate spasticity alone, but which in their common confirmation establish this diagnosis.

In the first place, secondary amentia, so often associated with spasticity, should not be confused with primary types of feeble-mindedness. Primary amentia is rather a general intellectual retardation, and is not an important part of the symptom-picture of spasticity. Secondary amentia, on the other hand, or the failure to negotiate intelligent conduct because of special disabilities, is associated with upper-neurone paralysis. The conduct of the primary ament is generally stupid and shows the same degree of stupidity in every part of his intellectual faculty. The performance of the secondary ament, however, is often quite intelligent. The disability is usually specialized, manifesting itself in failure of auditory association, motor control, visual memory, or of some more or less localized function; and serves to produce an end that marks him as an ament. Although many sufferers from spastic paralysis are primary aments as well, some are termed feeble-minded by the world when their intelligence test scores mark them as suffering only from localized lesions.

An analysis of the pathology of spasticity is further complicated by the fact that the spastic is not only spastic muscularly: he has many other neuropathic symptoms. Disease conditions and the consciousness of his handicap cause many asocial expressions.

The spastic is often emotionally unstable. This may be explained by the fact that the same condition that robs the cerebrum of its inhibitory control over many of the lower motor neurons, sometimes similarly affects the inhibitory control of the cerebrum over the basal ganglia, in which the emotions are subtended. Often this emotional instability presents itself in the great difficulty with which the spastic restrains crying and laughing. The violent changes of conduct, as well as the sudden swings from joy to sorrow, from affection to anger, and from amusement to fear, are associated many times with spastic paralysis. These personality changes in cases of cerebral lesions may be present without the paralysis, or the paralysis may be present without the personality changes: still the presence of one explains the presence of the other.

It should be impressed upon the mind of the spastic that emotional self-control is important in the control of his speech. He should be constantly reminded that his speech is always better when he is not emotionally disturbed. He should be trained to develop emotional self-control by avoiding those situations, attitudes and relationships that may arouse his emotions.

A part of his training for emotional control, as well as training for voluntary control of skeletal muscles, should be relaxation exercises. In practicing relaxation exercises, the patient should sit at ease in a somewhat reclining position. The teacher, supporting one of the patient's arms, manipulates it in various natural positions, reminding the patient to permit these movements, but not to assist or resist them. This feeling of passivity should be so thoroughly developed that the patient can produce it at will. It will help a great deal in securing this result if, at first, the patient will hold the rest of the body in a state of general relaxation. It is to be understood that nothing like a hypnoidal state is intended here. The patient shall consciously practice the tension and release of tension so that he can produce the latter at will. This type of relaxation is one of the highest developments of the voluntary functions of the cortex.

When one arm has been given attention, the other should be similarly used. After the arms, the legs should be trained and last the muscles of the face and neck. This practice should be carried over by the patient into many of his daily activities, and he should be cautioned to watch for evidence of tensions in his muscles and to develop the habit of relaxation until it becomes automatic with him.

The inability of the spastic patient to produce sustained tones without tremelo and tenseness points to the need for relaxation of the muscles involved in the production of speech. Voice exercises which aim at smooth, well modulated, relaxed tone production should be added to the program of relaxation suggested above. The use of the long and short vowel tables in connection with these exercises will prove very helpful. When the patient is able to produce the long and short vowels without noticeable cramps, the various consonant positions in combination with the vowels may then be taken up.

The degree of vocal relaxation can often be measured by the position of the thyroid cartilage. In muscular hypertension of the laryngeal region, the point of this cartilage may be drawn up near the base of the tongue, well under the hyoid bone. The patient should be taught to palpate his own thyroid cartilage, which will serve as a guide in his efforts at vocal relaxation.

It will be advisable at this point in our discussion to make sure of the meanings of our terms. As defined by Dr. Robert West, in "Disorders of Speech and Voice," spasm, spastic, spasmodic and their derivations are all descended to us from the Greek *spacin*, meaning to draw, stretch, or convulse. *Spasm* is a drawing, stretching or convulsing; *spastic* is drawn, stretched or convulsed; while *spasmodic* means characterized by drawing, stretching, or convulsion. Spasms are of two kinds: tonic and clonic. In the clonic type, the drawing, stretching or convulsing is brought about by the alternate contraction and relaxation of muscle groups, or by a more or less sudden contraction followed by a return to a relatively normal degree of tonus. In the tonic type, the contracting is steady and so uniform as to produce no movement. It is this tonic type of spasm that is the major symptom of what is called spastic paralysis.

The disability of the spastic to exercise control over the motor areas shows itself by the stiffness of the vocal and articulatory organs, either when moved voluntarily by the patient or when exercised by the teacher. Since the muscles of the jaw, throat and face normally yield less readily to voluntary relaxation than do the muscles of the arms and legs, the patient has more difficulty in relaxing these groups. The teacher will find that even when the spastic is doing his best to control these tensions his lips will be taut and his jaw will be opened and closed against a great deal of resistance. The platysma, omohyoid, and mylohyoid muscles will be found to form a tight covering over the throat and submandibular surface.

Facial spasticity may vary from the slightest touch to complete paralysis. The lesser degrees may be tested by asking the patient to do certain acts such as opening and closing the jaw, raising and lowering the eyebrows, and retracting and protruding the lips. In giving these tests the speed of the movements should be noted. Normally, the jaw movements should be about five per second. The eyebrow movements should be about three per second. Slow speed is considered a positive sign of spasticity.

Continuity of these movements should also be noted. A person normally should be able to execute these movements at full speed for ten seconds. A short span is a positive sign of spasticity.

Independence of movement of the two sides of the face is to be watched for, also. Bilateral independent movements of the corners of the mouth, of the eyelids and eyebrows are difficult for the spastic.

In breathing exercises, slow respiratory movements are made jerkily, while rapid panting is difficult and cannot be prolonged for more than a few cycles.

A further sign that the spastic lacks control over his motor areas of speech is the fact that the pitch of the voice may be either higher of lower than normal. This depends upon the relative strength of the muscle-group that elevates the larynx as compared with the muscle-group that depresses the larynx and relaxes the vocal cords. The voice in either case is monotonus, except when the spastic is under emotional strain. The normal, continuous inflection of pitch is never present and when it does occur, as in emotional conditions, is often uncontrolled and exaggerated. The voice may also be over loud in volume. The changes in voice that the normal person employs unconsciously to show meaning and emphasis are wanting in the spastic. Except, perhaps, for a tremor, the voice has a fixed intensity. The best word to describe this quality is tenseness. There is apt to be a degree of huskiness of voice, sometimes amounting to positive aphonia. This aphonia is not, however, a whisper, characteristic of flaccid adductor paralysis, but is rather the constricted adductor type. The utterance of the spastic is slow and very labored. The rhythm is sometimes scanning, in which every syllable is given the same amount of time and stress.

The utterance exhibits many phonetic lapses. These phonetic failures appear more often in sound combination than in individual sounds. The more intricate and delicate the movements involved in an individual sound or sound combination, the more difficulty the spastic will have. For example, the consonents *s* and *z*, which not only have a definite tongue position but also a special arrangement of the intrinsic muscles of the tongue, sound in the speech of the spastic like *sh* and *zh*. This is due to the fact that the small muscles are unable to groove the tongue for the *s* and *z*.

Since the soft palate is over tense, the whole speech of the spastic is apt to be nasalized. Furthermore, sound combinations which involve rapid movements of the tongue-tip and lips, such as the test phrase *Methodist Episcopal Church*, are slighted, transposed and slid over by the spastic.

As mentioned before, the spastic paralytic may also be mentally retarded. This type may show not only the paralytic defects of utterance and phonation, as previously discussed, but may have the linguistic defects of the ament. This type of speech is called *lalling*. Lalling, as the word implies, signifies an acute sluggishness of the lingual muscles when speaking, and is taken from the Latin word meaning "chattering." This defect, however, is found only when there is a definite organic lesion or general akinesis.

The re-education of the speech of spastic cases is at best a slow process. Persistent training at least twice daily should be given by a teacher of phonetics. It is often necessary to begin with the training of individual muscle groups in the production of elementary sounds which can later be combined into the production of speech sounds. This muscle training should be done before a definite program of phonetic training is started.

As the muscles of the tongue lack coordination, tongue gymnastics should be used to develop a faster response to stimuli. Tongue gymnastics were first introduced by Gutzman in 1845, and are still being used by many speech therapists. They should be practiced to count and with the aid of a mirror. Tongue gymnastics should be given in the following order.

1. Pointing tongue outward and upward to nose.
2. Pointing tongue outward and downward.
3. Rotating tongue around lips, beginning at the right and going up.

Rotating tongue around lips, beginning at the left and going up.

5. Raising tip of tongue to hard palate.
6. Curling tip of tongue under.
7. Raising the entire tongue to the hard palate.
8. Grooving tongue and pointing it outward.
9. Expanding and relaxing the soft palate (uvula).

To aid further the speech re-education of the spastic, the teacher should use calisthenic exercises for muscles of the face, mouth, throat and chest. Definite exercises cannot be suggested here, as the teacher must devise exercises to suit the individual case. These exercises, however, should fall into the following categories: (1) repetitive movements, such as opening and closing the jaws, raising and lowering the tip of the tongue, and rounding and relaxing the lips; (2) independent movement of the two sides of the face, such as contracting the muscles on one side, while the other side of the face remains passive, closing one eye while the other remains open, and rotating the tongue around the lips; (3) complete and forceful movements such as the opening and closing of the lips with the jaws closed firmly, and the drawing up and down of the eyebrows.

The advice of an expert in corrective physical education should be called upon for exercises pertaining to the muscles of the neck, chest, and abdomen. Breathing exercises should be employed to bring about better tone control, and also to bring the breathing movements under voluntary control. To assist in the lessening of the spasms in his respiratory movements, the spastic should be taught to breathe in and out slowly, deeply and evenly, holding the breath after each inhalation and exhalation, and starting again after every hold as smoothly as possible. The abdominal type of breathing is best used here. Dizziness and fainting should be watched for when the spastic is taking breathing exercises, and he should be stopped before their effects frighten him.

Panting is another valuable exercise. The tempo should be rapidly increased, five cycles per second being the most the patient should aim for. Breathing exercises should not be continued for more than fifteen minutes at a time, and four periods a day are sufficient. Exercises should be performed with accuracy and responsively, otherwise little benefit will be derived from them.

It is often helpful to carry speech training along hand in hand with general physical exercises. The patient may be urged to talk, count and recite simple rhymes with the exercises. The attendant should correct his mispronunciations, and establish a definite speech pattern for him to follow. The attendant may also have the patient repeat vowels, consonants and words. It is to be remembered that, before beginning any exercises, the spastic must aim for relaxation.

Some Observations on Muscle Training Under Water

By Ruth Aust

The reestablishment of impaired muscle function under water involves many special considerations. The first is getting away from the swimming ambition. One must get used to thinking and observing muscle action in water. Thinking kinesiology in a water medium is like thinking in four dimensions instead of three. It offers its own scale of difficulty for muscle work, because it takes less effort to move in water. Then, too, the problems of fixation are quite different from the usual analysis.

These observations and problems are intended only to indicate an attitude for approach. The whole should be read before any part may be analyzed fairly.

The first problem seems to be the appreciation of muscle activity in this medium. This involves a knowledge of the fluid, water. Here are a few laws to be recalled:

a. A floating body displaces its own weight of liquid.

b. A body wholly or partially immersed in a fluid is buoyed up by a force equal to the weight of the fluid displaced.

c. Hydrostatic pressure increases directly with distance from the surface of a fluid.

d. The frictional resistance of a body of fluids is called the viscosity of the fluid.

e. Pressure (neglecting viscosity) on the side of moving fluid varies directly according to the velocity of the motion.

These can be computed into accurate solutions if one cared to work out the separate formulae. Based upon these facts, there seems to be a definite gradation of difficulty for muscle function. Following are seven variations arbitrarily differentiated. In the discussion of each gradation, the origin of the muscle is presumed to be firm, held either by the operator or by muscular fixation.

Numbers are used to denote a comparative gradation of difficulty.

I. Active passive movement: The patient attempts the contraction voluntarily of a muscle while the operator performs movement of joint.

II. Contraction against viscosity: Contraction of a muscle moving the joint so the movement is performed parallel to the surface of the water.

When a body sinks to the point where it lies as a dead weight on the water, it is buoyed up by the pressure exerted by the water, equal to the weight of the resting body. This force is distributed to all points of the body and to the water just as though it were supported on a table.

Then in order to move it sideward, the upward pressure remains the same. There is only the viscosity or frictional resistance of the water to be overcome. Muscles able to definitely tense but unable to move a joint out of water are able to function in this situation.

The movement in this position is merely overcoming joint friction and the resistance of lateral pressure of the water. A minimum of reflex control needs to be sent to the stabilizers of the joint. The stabilizing factor seems so much more demanding in water than out that thoughts of it must be linked with the least contraction. Suppose the body were floating supine and the legs were voluntarily moved in abduction: tension of the extensors, flexors, external, and internal rotators, is necessary. Due to the position of the body and the direction of movement, however, the tension necessary for the stabilization of the joint is about at a minimum. I believe in water there is more relative activity of the stabilizers of a joint than in other muscle training work. In other muscle training, the weight of the limb fixes it to the table. In water, the guy wires must do more work. A marked inequality of muscle power has the same deforming effect in both.

III. Movement aided by buoyancy but against gravity pull and weight of superincumbent water:

The contraction of a muscle lifting a limb from below water toward the surface should be from the limb's buoyant level to any higher level. There is that part's weight in water to be moved upward. This presupposes the floating level to be below the surface. The work is done by the muscles pulling from the insertion toward the origin. This act then consists of the intrinsic muscles moving the limb upward from the buoyant level and the extrinsic muscles stabilizing the origin of the intrinsic ones. The extrinsic stabilizers of the joint are more involved in proportion to the greater effort. There is only slightly more work required of the intrinsic muscles than in number two.

IV. Contraction of a muscle pulling the part downward from the surface toward the bottom:

This overcomes the buoyancy or the upward pressure of the water. This pressure is equal to the weight of the body but it is distributed equally against the lower surface. The resistance increases with depth. I believe the intrinsic muscles are more concerned with the depth or range of motion but the extrinsic must equalize the leverage action against this total upward pressure. In other words, if one is lying on the back and forces a leg into extension, the glutei perform the range of motion but the back extensors also extend the body against the water to equalize the fixation.

V. Contraction of a muscle from both origin and insertion:

When familiar with water as a medium, this action of muscles looms large. New possibilities for improving trunk muscles especially are offered.

For example, while floating, the twisting of one pelvic crest toward the opposite rib margin may be performed either by using the thorax as a fixed point toward which the obliques pull, or contracting both internal and external obliques from both origins.

VI. Contraction moving part upward into air:

Contraction of a muscle moving a part upward out of the water, loses upward pressure of water and adds immediately the load of gravity (not that there is not gravity pull in the fluid, but there is so much more weight in the air). This Number VI involves the intrinsic consideration only.

The work is in proportion to the amount of the part lifted out of water. Any range less than lifting the complete part involves less weight and gravity pull than the corresponding movement on a table, because the weight of the part is still made partially bouyant.

VII. Extrinsic fixation: Extrinsic fixation must be directly in proportion to intrinsic action which is governed by load to be moved and the directional control.

The following are two examples:

a. Abdominal muscles prevent the pelvis tipping forward while the patient adducts legs parallel to the surface. (Depending on the anteroposterior alignment and muscle power this may not be the invariable fixation group.)

b. Supine float, left arm and right leg lifted above surface of water throws the combined weight of the arm and leg on the left pectoral, serratus magnus, left external oblique, right internal oblique, and psoas. The entire group acts in series, as though one muscle were contracting from both ends.

Some of this gradation of difficulty could be challenged as to comparative rating because of the complexity of individual variations.

One factor deserving cognizance is the fact that a muscle may receive muscle training for years, but when its action is performed in a group coordination, the power increases still further. This is because the tension load may be worked to maximum strength by developing it involuntarily as an extrinsic stabilizer besides voluntarily as an intrinsic actor. In this respect, under-water muscle re-education differs from the usual muscle training but resembles gymnasium exercises in that in any action not only do the intrinsic muscles need to be trained, but also the muscles which immediately control the place of origin. These must be *taught* to steady the starting point of the given muscle. This action has been expressed as extrinsic fixation. It is the control of the base of action.

Before going into an analysis of exercises as they are done in water, it seems desirable to compare the water modality with regulation remedial gymnasium.

The greatest differences between the gymnasium and water from a kinesiological viewpoint are:

1. Water allows an opportunity for the muscle to be contracted from both ends.
2. In the gymnasium or treatment room the body has a definite resting place.
3. In the pool the flow of fixation goes completely around the body as though it were a cylinder. The movement seems to spread to more synergists, and an unbalanced strong muscle assumes disproportionate acting, hence greater importance. The ability to "think in terms of water" seems to be the power of comprehending the differences of fixation between water and other treatment work.

Grossly speaking, these are three positions in both. In each, the fixation varies according to the positions of the body.

Following is just a brief summary of the gymnasium and treatment room problems given to make the contrast with those under water.

Here the body has a definite resting place.

a. It may be lying on a table. The weight of the body or limb has immediate support. There is no balance or equilibration stress.

b. It may be in a sitting position. The muscle activity becomes more involved. Postural strain, tension, and weight graduate the difficulties of muscle function. In this position a typical exercise analysis might be the effort of abducting one arm. The abductors of the arm, the fixators of the shoulder girdle, and the lower trunk muscles synergistically are used. However, the fixing point is the stool.

c. In standing, there are added the problems of joint stability and equilibration. The place of fixation is the floor.

Paralleling this crude grouping are the three positions in water.

1. On the table:

a. If the body is *supported* throughout its entire length by a *submerged flat table,* the situation most closely resembles the gymnasium. The body does not float. Its weight is supported by the table.

b. If the table slants so that the lower trunk floats, the situation is quite different. The stabilizing points are the semi-supported thorax, the head, and the hands (if holding to something).

2. Body not supported but fixed by hands or feet.

A. Body parallel to surface:

(1) When the body floats and the hands hold the side rail, the strain is either carried in the elbow or shoulder muscles. Arms spread in a "Y" with elbows straight, throw the burden of fixation on the scapular and shoulder groups.

(2). The body floating with the ankles held, the fixation effort is in the femoro-pelvic groups. At least it is more desirable to keep it there and reduce it to a minimum in the foot and knee muscles. These often over act in trying to assist the fixation.

B. Body at right angle to surface: (side lying)

In a side lying overhead grasp position, the lower hand (left) holding to some submerged bar and the upper hand (right) grasping at the level or above water surface, the pectorals are prominent fixators.

3. Free floating:

In the free floating position an imaginary spot in the thorax just above the abdomen is the center of gravity. Every movement that causes a change of weight distribution spreads until the point in the thorax has made its weight adjustment in the water. The muscles holding the pelvis in various relations to the chest, are in constant play pulling the parts into the desired relationship to the thorax.

No matter what the problem is, the body adjusts its position so a central axis could imaginarily be drawn with bulk equalizing the balance of both sides and up and down along this axis—from tip of head to tip of toes. It may not be symmetrical but it will be cylindrical in weight distribution.

With these positions in mind, it is easier to discuss co-ordinations developed in under-water muscle training.

This leads us to the various exercises for muscle training in water. There are two kinds:

1. Muscle training for voluntary isolated contractions: "intrinsic."
2. Exercises deliberately planned to stimulate the muscles involved as fixators: "extrinsic."

The first grouping is the orthodox type, as done in muscle training in the treatment rooms.

The second, or extrinsic, exercises cannot be suggested dogmatically because of the differences in individuals. The postural alignment, muscle power, muscle balance, and localizing control must predetermine the exercises. For example:

Suppose the erector spinal muscles were weak. Leg adduction, during a supine float, with more tension on external rotators than internal rotators, will synergistically call the back muscles into play.

From the leverage approach, we can localize in areas impossible to get voluntary isolated contractions. As an example: patient lies prone with arms in "Y," legs abducted, and raises one arm and opposite leg. The leverage on the spinal muscles of the dorsal lumbar region localizes a tremendous load. Those muscles carry the cross tension necessary to stabilize both the pelvis and shoulder girdle. It is the fulcrum between the two working arms of leverage.

Another approach for exercise is to use co-ordina-

tions involving the same principles plus balance. Patient walking in water must learn when to exercise voluntary isolated contractions (intrinsic movements) and the efficient use of combining efforts of extrinsic muscles.

Then there are the exercises evolved from using the trunk as a cylinder. The cylindrical action of the combined muscles is best illustrated with the "log roll."

The action requires the body to roll over smoothly, describing a complete rotation around a central axis. The simplest position to start the roll is: supine floating, one arm above head, other holding nose (if breath control necessitates) and legs together.

Analysis of the action is cylindrical. If a round movement could be taken into sections:

Given left arm up, right hand holding nostrils, legs together.

1. Contraction of right internal oblique, left external oblique, and tension of both transversali which lifts right anterior pelvic crest upward and pelvis rotates left in relation to chest.

2. Contract left scapula adductors and depressors. This causes continuous pull from right pelvis around to scapula adductors, serratus and lattisimus dorsi. The body rotates to left side lying position while continuing to float. The low back muscles work in varying degrees. The normal usually uses left quadratus lumborum in effort to fix scapula.

3. Returning to the starting position continues by movements initiated in reverse:

Left scapula adducted, tense left external and right internal oblique, to produce right side lying. Scapular adductors and latissimus dorsi continue movement until patient is supine again. Other synergists often undesirably offer assistance to accomplish the back lying position. The right quadratus lumborum may want to help the left external oblique.

This is sufficient to realize an appreciation that the individual and cooperative actions of the muscles make it necessary to study the patient carefully to prevent an unexpected twist or malposition. It is when the deviating factors exist that the problem becomes so complicated. The picture is exaggerated in water because of the over-action of contracted muscles in an unassisted effort for fixation.

After a period of time in under-water muscle re-education, we learn to anticipate certain tendencies for compensation. Some of these, as I said, are due to kinetic unbalance, some to structural conditions, some to malpositions in the water, and some to coordination difficulties.

It is rather difficult to group them. The most natural discussion would be to parallel the progression of the patient as he increases his familiarity and skill in the water.

With trunk supine in a semi-float position on the inclined plinth, the arm position makes a difference as to the muscles required to do the most work.

If the arms are held at the sides, hands grasping the plinth, the pectoralis major and minor, teres major, serratus magnus, and latissimus dorsi (transmitting pull through the triceps) do the most work. When performing a lateral bending, the body will pivot at the shoulder joint, using the insertion of the muscles as the fixed and the origin as the working points.

Because of pectoral activity, the chest is proportionately depressed. If the arms are held above the head, elbows flexed shoulder high, and hands grasping in supination, a different group of muscles is in play. The pectorals are eliminated so the expanded chest makes for greater buoyancy.

An error that often occurs is the fixation of the thorax to the arms and head. This is due to the strong unopposed activity of the sternocleidomastoid and pectoral muscles. The abdominal muscles failing to steady the rib cage, the thorax lifts toward the arms and head and is pulled away from the pelvis.

If there is even a tendency for this unequal pull another evil may be anticipated. The action of the psoas is apt to cause an increase in the angle of the pelvis by tipping it toward the legs. Its contraction will flex pelvis and legs together.

Another observation is made about plinth work. If a movement involves lifting the legs to or above the surface of the water, there is likely to be introduced a definite back extension. The head is pushed against the support to help give a point of purchase for the legs.

This is not an exhaustive summary of compensatory movements made while doing table work. It is intended only to indicate the sort of things one must anticipate and watch for. A pool technician must always be aware of the muscle action back-stage of the visible movement. Otherwise, compensatory deviations may insidiously develop.

Following the plinth work we usually proceed with exercises in the floating position with hands holding the rail.

Let us analyze several exercises.

When the body is steadied in this manner, if a lateral trunk bending is done with the arms held in extension, the shoulder muscles again move from origin toward insertion. This lateral bending is performed with contraction from both ends of the corresponding rectus abdominis, both internal and external obliques, quadratus lumborum, sacrospinalis; tensions of the transversalis and leg abductors; contraction from the origin to the insertion of the teres, trapezius, rhomboids, and latissimus dorsi.

This position can be used to demonstrate still another kinesiological variation possible in water. It occurs in the action of jack-knifing the body in the middle, keeping the head and feet at the floating level. The control should come from the abdominal muscles contracting from both origin and insertion. In this position also there is the same tendency to lift the thorax away from the pelvis.

This side lying position with arm fixation overhead provides an excellent opportunity for observing a variety of different movements. The anteroposterior alignment is especially exposed to view.

In various distribution of paralysis of lower trunk muscles, the patient performs all exercises according to his peculiar involvement. He stabilizes with his strongest muscles. He may perform the same movement with an entirely different result from another patient.

The action of flexing the thighs while lying in this position may be executed in a number of ways.

The quadratus lumborum of the upper side will probably tense to help prevent the pelvis from sinking. Similarly, the latissimus dorsi of the upper side, pulling from a fixed arm, raises the lumbar area and aids in straightening it if spine is curved to the opposite side.

Normally, the flexion is done by the psoas beginning the action. It pulls the spine and legs together tending to cause an increased inclination pelvis which must be checked by the abdominals. Great caution must be used here. Under intense effort the sacrospinalae group will be stimulated to over-act. Instead of simply stabilizing the pelvis posteriorly, it will in the presence of weakened or under-activated abdominals, actually in-

crease the pelvic obliquity by hyper-extending the lumbar spine.

If there is a weakness in one of these muscles, any number of compensatory movements or positions may be seen. If the abdominals are relaxed or paralyzed, they stretch under tension. Then the sacro-spinali group not only hyperextends but locks the lumbar spine. The pelvis tilts forward still more. This same condition will usually occur in posture cases having round hollow backs even though no muscles are paralyzed.

More frequently than suspected, there is an uneven action of the abdominal muscles. For instance, the lower portion of the external oblique often is a strong fixator. It draws the ilium and the ribs closer, stretches the opposite external oblique, twists the thorax toward Poupart's ligament, and causes a synergistic tension of the quadratus lumborum and latissimus dorsi on the same side. The contraction of the sacro-spinali muscles will consequently tend to be asymmetrical. And all this occurs as an effort toward the stabilization necessary for psoas effort. This also takes place somewhat in scoliosis cases and should be guarded against.

Still using the same exercises of flexing the legs, a round back with over-action pectorals affords another variation. The movement is done with such a powerful pectoral contraction that the body will almost become the movable part while the feet remain stationary. The pectorals, intercostals, and abdominals overact. Here the abdominals and pectorals act together. The tension of the abdomen to prevent the pelvis from tipping is transmitted continuously from the pelvis to the arms by way of the pectorals.

So the area of synergistic effort spreads and increases in direct proportion to the smaller amount of fixation.

In the "free floating" the problems are endless, all the forementioned are observed according to the patient—his co-ordination, his muscle power, and his alignment.

There are some short-cuts one learns by experience.

Often, the average "normal" healthy person who cannot float, could learn to if his segmental adjustments were studied in terms of kinetics and mechanics.

Floating supine should be easiest when the arms are held above the head in a "Y" position and the legs are abducted about forty-five degrees (avoid a flexion-abduction). The center of gravity is thus placed in the most central position of the bulk to be buoyed up. Arms and legs are equally distributed around the chest which acts as the hub for the spokes of the wheel.

Localized effort for slight contraction of rectus abdominis is usually necessary. This aids in preventing the legs from sinking. Then if the scapular adductors are contracted the pectorals are forced to relax (Sherrington's Law). The pectorals should not be active even synergistically if the arms are held in this fashion.

This position also promotes confidence. The muscles which tense to express the physical attitude of fear, as it mirrors the mental attitude, are the flexors of both arms and legs. The constant tensing of muscles to right the body on the water surface is inevitable. Therefore, if the body is in such a position that those muscles are not the flexors but the abductors, there is a mental advantage—hence composure.

The common tendency is to try to keep the head high. The tension following the axis of the body is transmitted to the low back muscles. The more the head is lifted, the more level action required in the low trunk; the more uneven the weight distribution, the more the legs sink for counter-balance. The body will continue to go feet first until a perpendicular relationship to gravity pull is assumed. As stated before, the body displaces its weight in water and will sink no lower. Position in water is determined by the relative position of the members of the body to the center of gravity.

Inherent in all pool activity are certain psychological obligations and possibilities.

By obligations, I mean the patient has the right to receive a psychologically sound introduction to activity in water. A helpless person is all the more helpless in water, hence he usually fears it. The handling of patients in water calls for a very special psychological technic that can be learned only by experience. By this means is developed the patient's ease in water. Speed in learning co-ordinations also must be built upon acquired skills that are psychologically needed as a basis.

Nature gave us instinctive urges to achieve certain types of accomplishments at certain ages. These instinctive stimuli will furnish motivation to provoke kinesiological effort. Changing instinctive mobility in water into kinetically planned movements is like harnessing electricity. Neurotic or hysterical symptoms are hard to maintain in a strange modality while doing strange movements. Even apprehension about moving a sore joint or a part with an old fracture, is avoided if movements are localized so only the synergistic action provokes the joint activity.

The future of under-water gymnastics from the psychological viewpoint is fascinating, but its discussion would require treatment in another study.

The speed in gaining proficiency in co-ordinations and skills is in ratio to the effort concentrated on them. Play is usually eliminated during the period of active remedial treatment.

Following this concentration, however, recreative and play elements may be adopted within certain limits provided no movements are done which might neutralize what has been taught or what should be taught.

For muscle training, let us say the neuro-muscular urge to play in water should be directed into sound beneficial muscular performance with movements scientifically designed for the improvement of the individual's body.

Injuries of the Knee Joint

C. W. Peabody, M.D.*, Detroit, Mich.

From the industrial standpoint knee joint injuries merit increasing consideration in the pressing effort to shorten temporary and eliminate or decrease permanent disability. Non-occupational accidents to this joint also seem to be on the increase with the elevated tempo of modern life and activities, and are even more prone to be given less serious attention than they often deserve. It is the purpose of this paper to review the more important types of injury, and the methods of treatment as developed by those dealing mainly with joint problems.

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For the purpose of brevity purely extra-articular lesions such as acute or chronic prepatellar bursitis, ganglia, etc., will be omitted, and the discussion divided into the following headings: (1) Strain and Sprains, (2) Internal Derangements, (3) Dislocations, (4) Fractures, including patella and (5) other injuries of the extensor apparatus.

STRAIN AND SPRAINS

The writer selects the term strain for disturbances of the knee developing gradually from use without any primary exciting incident, yet often aggravated by a comparatively minor injury. The location of the lesion is usually the mesial collateral ligament of the knee, with aching or pain referred to this area, a sensation of stiffness, sometimes a limp, and if sufficiently chronic possibly a slight synovitis with effusion. The etiological factors in chronic knee strain are static, resulting in undue tension on the mesial ligaments from valgus posture in leg or foot. Their persistence may lead to sufficient stretching of the collateral ligament to impair also the attachments of the coronary ligament to it, with meniscus hypermobility and predisposition to displacement. In addition to the valgus strain itself, badly pronating feet produce a torsion strain on the knee with each step, favoring irritation of ligaments and meniscus. The examination in strain will show discomfort referred to the inner side of the knee on forced abduction of the knee and forced hyperextension. If the irritation involves the coronary fibres, pain will also be produced on torsion of leg on thigh. The treatment in severe cases may require complete rest or fixation, but ordinarily alleviation of the static defect by the Thomas heel or by the Whitman weak foot brace, plus strapping of the knee (criss-cross with decussation over the ligament) and physiotherapy, including primarily massage, with preliminary baking, and exercises to tone up the quadriceps apparatus, especially the vastus medialis portion, constitute the treatment program.

Sprains of the knee are considered as acute injuries, involving a sudden stretching and more or less tearing of ligamentous fibres, contusion of joint surfaces, and synovitis with varying degrees of effusion. Immediate pain is experienced, with a short period often following of quite mild discomfort, and after some hours steadily increasing pain on use, with disability. Swelling due to the effusion gradually develops. To examination there will be a varying degree of generalized tenderness to palpation, more acute over the collateral ligament that received the strain, and if some slight degree of meniscus loosening is involved, the tenderness will be present also along the joint line anterior to the collateral ligament. Fluctuation ballottement of the patella will occur with the presence of effusion and to inspection there will be fullness with obscurity of normal anatomical markings. Voluntary muscle protection may prevail but motion will be obtained to nearly full extension and to right angled flexion or more depending on the effusion. To manipulation there will be marked pain on lateral stress referred to the collateral ligament on which tension is being placed. If pain is produced on same side by stress in opposite direction, some degree of meniscus injury has also occurred, and pain on torsion will be equally marked.

In the milder grades of acute sprain use of the knee may be permitted with strapping, or bandage or a felt and flannel support, but considerable reflex quadriceps atrophy is likely to develop, with ensuing instability, and should be combated later by massage and exercises. Any effusion that floats the patella should be aspirated. This is very important, for the resultant capsular stretching otherwise will leave the joint unstable, and will also result in excessive reflex quadriceps atrophy. In any case with a considerable effusion, and especially with any degree of hemarthrosis, fixation of the joint for from one to three weeks should be accomplished. This is best done by cast, which should immobilize the joint, and to do this must extend above to the trochanter. Physiotherapy should follow till quadriceps function is normal. If primary hypermobility was present, a jointed knee brace to prevent lateral strain is indicated for one to three months. With effective initial treatment the immediate disability may be as little as one week and never over four, and permanent disability should not occur. However, with some acute sprains moderate impairment of the integrity of the meniscus, sufficient to ultimately require classification as internal derangement, may prevail.

INTERNAL DERANGEMENTS

Of the various internal derangements of the knee, injury to the meniscus (semilunar cartilage) is the most common. The mesial meniscus is involved about ten times as often as the lateral one. In its milder grades it is often difficult to distinguish from acute sprain, and will include the usual symptoms of the latter. However, if the patient obtained a sensation of dislocation or of the knee "going out" at the time of injury, a displacement or a tear of the meniscus is to be suspected, and fairly strong corroboration obtains from certain manipulative tests. Assuming a mesial meniscus injury, manipulation producing a varus stress will be more painful than one in valgus, and torsion in eversion will be more painful than in inversion. For an external meniscus the reaction will be in reverse fashion. Also confirmative is the presence of tenderness along the joint line anterior to the collateral ligament and over the alar ligament.

The least severe meniscus injuries consist of stretching or partial tearing of the coronary fibres which attach the cartilage at its outer border to the head of the tibia, and so permit the meniscus in its anterior third to move too far under the femoral condyle in flexion and be jammed there for an instant on the returning movement. In a more severe injury the jam may be more complete, and since, as has been shown experimentally, the amount of compression ensuing between the two bones when the collateral ligaments are intact and the knee extends over even a thin substance between the joint surfaces, is enormous, the cartilage will be torn or fractured. The fracture may be a linear one, running circumferentially around the length of the meniscus, and the central portion will be displaced across the head of the tibia to lie toward the center of the joint under the intercondylar notch.

This is a nuisance injury, as the knee may become free again in motion and symptomless for periods, with occasional drifting back of this loop of cartilage under the condyle and momentary "catching" and "giving way" of the knee. Frequently one has to depend almost entirely on story and subjective symptoms for the diagnosis of this particular lesion. Occasionally this very thin central loop or fragment may wear away by attrition and absorption and the joint become permanently symptom-free.

A more severe form of meniscus damage results when the entire relatively mobile anterior third gets caught under the condyle and is snapped inward, completely severing its attachments to the front of the tibia. This produces the most typical symptomatic picture of internal derangement, with intermittent complete lock or block against extension and great pain.

The fibres passing to the cornu from the alar ligament may hold and make possible manipulative or spontaneous reduction by their effect in drawing the mobile end back to the front of the joint. Otherwise this type of meniscus injury without surgical treatment is very likely to leave a permanent internal derangement of the knee.

The last form of cartilage lesion is the so-called bucket-handle fracture, in which the middle third or more of the meniscus is torn loose from the rim of the tibia, flopped over on itself and displaced to the intercondylar space. The knee will then operate without actual locking but with a clicking or heavy crepitation and full extension is never possible, with the attempt productive of pain and a tight feeling behind the knee as the posterior capsular ligament receives the leverage tension.

The treatment of meniscus injuries may take three forms according to the severity of the lesion. The partial loosening or mere hypermobility may be controlled by several weeks of strapping to prevent rotation and abduction, followed by physiotherapy to ensure maximum muscular stabilization. Recurrence, however, should lead to cartilage removal. Some anterior horn dislocations may be manipulated into place, with residual completely normal hyperextension the criterion of reduction, and, after plaster fixation for a month followed by the use of a knee cage brace, permament healing of the torn ligaments and recovery of stability may occur. Recurrence, however, may be considered an indication for removal. In complete central displacements and bucket-handle fractures, evidenced by a block, and inability to bear weight without pain, operative treatment is the only recourse.

Arthrotomy for Cartilage Injury

In skillful hands the surgery of meniscus injuries is almost invariably successful and highly gratifying. It does require a meticulous aseptic technic, delicacy of manipulation and more familiarity with the internal anatomy of the joint. It frequently can be performed without difficulty with local infiltration anesthesia. It is important that the indications be definitely established, but the exact form of derangement may often be ascertained only at operation. Operators with considerable experience in this field of surgery have learned that a moderate amount of meniscus hypermobility may maintain derangement symptoms, as proved by relief following the removal of the cartilage. In a rather large experience the writer has but once entered a knee joint with a diagnosis of meniscus injury without finding demonstrable evidence of pathology; but the general experience seems to be that with a suggestive history and examination, a questionable degree of cartilage hypermobility is best treated by removal.

The joint cavity is approached through a short curved incision at the front but nearer the affected side, yet should not divide the mesial collateral ligament. The joint cavity is reached by a systematic incision of the various layers and careful ligation of the plexus of vessels beneath the fibrous capsule, before the synovial membrane is opened, and the latter is then incised under tension between clamps as in entering the peritoneum. The primary opening should be well above the joint line and carried down to the latter under direct vision, to avoid incising the meniscus and coronary ligament in the event of a peripherally split cartilage lesion only. A narrow blunt retractor draws the alar ligaments out of the way, the knee is partly flexed and the cavity inspected. In the type of lesion just referred to the centrally displaced loop may alone be excised, if the peripheral portion is not hypermobile. The normal degree of mobility must not be forgotten.

In anterior horn displacements it may be feasible to remove only a half or two-thirds of the cartilage. In bucket-handle fractures it has been the writer's practice to remove the entire cartilage completely, and if the knee is flexed and rotated and a special knife used this is not very difficult. If the knife hugs the cartilage closely there should be little residual bleeding. Opinion differs as to desirability of a tourniquet. Experience in operating under local anethesia has led me to consider it of no important assistance. It is essential that great care be used in the placing of retractors, that intra-articular sponging should be minimal and only with moist gauze or cotton pledgets and that hemostasis be as complete as possible. A light absorbable suture, double or single or plain catgut, should close the synovial membrane, slightly everting its edges. A heavier chromicized suture or silk should be used for the fibrous capsule.

On the whole it is probably advisable to follow operation with a short period of immobilization and my own preference is for the posterior (Cabot) splint rather than plaster. A heavy moderately compressive flannel dressing is applied over the knee first. The patient should remain in bed for a week. A rise of temperature of one or two degrees may be expected in the first two days but it should be normal by the fourth. If postoperative effusion is slight or absent, on the fifth day massage from patella to the hip is begun in the splint. The latter is replaced at the end of a week by a heavy felt and flannel support and motion encouraged. At this stage the patient may be up and about on crutches and weight bearing should be encouraged after the tenth postoperative day. Physiotherapy should continue till quadriceps tone returns to normal. A normal range of motion can be expected within a few weeks. Very slight excess lateral mobility may persist for a while, but with good quadriceps tone functional stability and recovery should be complete and former occupation resumed, as well as capacity for participation in the more strenuous forms of athletics.

Cartilage Cysts

Before leaving the subject of semilunar cartilage lesions a relatively infrequent type of pathology should be mentioned, which has been considered as a sequela of joint strain but is probably a degenerative condition not etiologically traumatic. I refer to cartilage cyst, extremely rare in the mesial meniscus, being usually in the lateral one. The symptoms are a gradually developing aching or boring pain at the side of the joint, aggravated by walking or by forced extension of the knee, and often first noticed after a minor injury or bump. Very early a soft swelling will have been noted. To examination the joint is free from evidence of injury, there is no clicking but there may be a few degrees deficiency in extension. Visible at one side of the joint line is a small swelling which is soft, cystic in feeling, and slightly tender to pressure. It gives the erroneous impression of an extra-articular sac or ganglion and this is important in planning surgical intervention. It should not be confused with bursa or ganglion, as it is not in relation to any tendon. The treatment is operative and means the complete excision of the meniscus, as removal of the cyst alone invariably seems to be followed by recurrence, and the cartilage elsewhere on microscopic examination will give evidence of cystic degeneration.

Joint Mouse

The next form of internal derangement of the knee to be considered is "joint mouse" or loose body. When

multiple (osteochondromatosis), a background of chronic hypertrophic synovitis exists and this type does not belong in a traumatic classification. Joint sprains, however, may involve a nipping of a synovial fringe, followed by fibrous and chondrous degeneration, with production of a pedunculated or free loose body. Or a bit of cartilage may be detached and continue to grow from the adequate nutrition of the synovial fluid. Catching and clicking will be a symptom, but unless the "joint mouse" is large and palpable, locking or limitation and pain on manipulation will not be found, and synovitis will not occur. When a pedicle persists, calcification in the loose body may occur, making it roentgenologically visible. The "joint mouse" is frequently migratory. As long as it lies in the quadriceps pouch, although palpable, it will not be very symptomatic. If it migrates into the lower compartment it produces clicking, catching and pain. A special form of joint mouse found in the lower compartment is that known as osteochondritis dissecans, in which a considerable lozenge shape segment seems to sequestrate from the mesial condyle of the femur adjoining the notch. This location has led to a theory of impingement of the spine of the tibia in a rotation strain,, but this is debatable, and the pathology is also held to be an aseptic necrosis. The surgical removal of loose bodies is simple and does not require discussion, save for the point of final determination of the exact location of the joint mouse immediately prior to operation.

SLIPPING PATELLA

A form of derangement of the knee usually included in traumatic classifications is luxating or slipping patella. Unquestionably a certain form of injury with direct violence may produce a tear of the capsule and force the patella off the trochlea to the side of the condyle. In this event it is extremely difficult to replace by the patient and severely painful, with a marked effusion following. Recurrences are much easier and spontaneously reducible. However, most slipping patellas are basically congenital, with some degree of capsular relaxation and hypermobility present on both sides, and a family tendency usually prevails. The dislocations tend to be more and more frequent and become a disabling handicap eventually. While some improvement in stability may attend the use of a knee cap or a patella harness, it is rare that any permanent effect is obtained, and, as in recurrent dislocation of the shoulder, the only cure is operative.

Several measures of surgical reconstruction have been devised. Probably the best and simplest is the modification of Goldthwaite's operation, whereby the tibial tubercle carrying the patella tendon is detached and re-embedded an inch or so more mesiallly on the front of the tibia. The resulting mesial line of pull on the patella keeps it away from the danger point over the lateral condyle. In a rather limited experience with this condition the writer has found this operation very satisfactory, although in one case of a badly and repeatedly traumatized knee with great relaxation it was necessary secondarily to do a capsular reefing with forward transfer to the patella of the gracilis tendon. Each of the two latter procedures has been advocated in surgical relief of slipping patella, but alone is not as likely to be dependable. In a single case in an adolescent the writer was successful by means of a capsular reefing plus a silk ligament suspension tether to the side of the mesial condyle. Of a similar character is the operation of Gallie, of a tether by a fascia lata graft. All the above mentioned procedures can be performed without opening the joint cavity. Albie has advocated and successfully used a bone plastic operation in which the trochlea portion of the external condyle is loosened and blocked up higher with a bone graft.

RUPTURED CRUCIALS

An injury to the crucial ligamentous apparatus of the knee is the last and least frequent form of internal derangement. It may take the form of fracture of the tibial spine (which projects from the center of the head of the tibia into the intercondylar notch) and the fibrous repair may restore integrity of the crucial ligaments. The spine may not unite, but remain loose in the center of the joint causing locking symptoms. This is diagnosable by X-ray and removal of the bone is not difficult. One or both of the crucial ligaments may be ruptured, with ensuing great laxity of the joint in an anteroposterior direction, resulting in weakness and instability. In most instances fixation followed by the use of a competent brace for a considerable period will be followed by recovery of stability. For persisting disability Hey Groves devised an operative reconstruction in which strips of fascia lata or tendon are passed through decussating tunnels drilled across the joint through femur and tibia, and he has reported successful results.

Lateral dislocations of the knee, that is, of the tibia on the femur, cannot occur except as a result of one or the other of the above mentioned injuries to the ligamentous apparatus, which in itself makes the reduction of the dislocation easy and constitutes eventually the problem of the lesions discussed.

PATELLA FRACTURES

There remain for description in knee joint injuries the fractures, which will be limited here to those of the patella and of the head of the tibia. Fracture of the patella is a quite frequent joint injury, and one not necessitating the residual disability which is still too frequently seen. It may be discussed under two heads: first acute, and second ununited fractures. In a fresh fracture of the patella with not over ¼ inch displacement alone do we find a place for non-operative treatment of this injury. Fixation in an adequately long cast for four weeks without weight bearing, followed by walking for two more weeks in plaster or a rigid brace, and for two more months in a brace with a lock joint, is the treatment of choice. Fibrous union only will prevail for some time. In fractures with greater degrees of separation of the fragments the injury has involved extensive lacerations of the capsule and lateral expansion of the quadriceps tendon, and a weak fibrous union with likelihood of subsequent giving way, or the restriction of motion from adhesions, as almost certain to follow any treatment save open reduction.

Open reduction should follow as soon after injury as possible, and not, as sometimes recommended, after a waiting period in which joint adhesions will get under way. In a considerable series the writer has not failed to get bony union and from 90 degrees to normal motion as a result of operative treatment. It is my preference not to do a wiring operation, but to do a careful layer repair of the lateral tears, oppose the fragments by periosteal sutures, and re-enforce by heavy sutures running from quadriceps tendon over the bone to the patella tendon below. In comminuted fractures a circumferential suture of kangaroo tendon is sometimes of assistance. Plaster fixation follows for two weeks, when the cast is bivalved and massage started with active "setting" of the quadriceps and "shrugging" of the patella done in the cast. At the end of a month walking is begun in a long brace with lock joint and an adjustable stop which permits increasing the range of motion for the sitting position at a rate of about 10 degrees each week. The brace is

discontinued at the end of 2 to 3 months, depending on the rate of bony union as shown by X-ray, physiotherapy being continued during this period.

Ununited patella fractures present a more difficult problem, of course operative. The fragments must be freshened and brought into apposition and adhesions freed. Some form of more or less permanent internal fixation is indicated in a fracture of any standing, as bony union will be slow. Albee has advocated an inlay bone graft cut upon a double triangular pattern. A case in the writer's practice was worked out somewhat differently. A rather comminuted fracture had resulted under non-operative treatment in persisting separation, fibrous union and marked limitation of motion, complicated a year later and 10 days before coming under my care by a fall and very extensive separation. At operation the widely separated fragments were gradually brought together, stretching down the contracted quadriceps with the help of a screw clamp for the patella originally advocated for external fixation. The adhesions having been freed until full motion could be obtained, the fresh lacerations in the lateral capsule were carefully repaired and sutures placed in periosteum and fascia across the fracture line. Inasmuch as bony union would probably be slow and as early motion was desired, some means of maintaining living continuity of the extensor apparatus seemed indicated. Accordingly, the stout heavy tendon of the peroneus longus muscle was removed in its whole length, the proximal end the stump being sutured into the peroneus brevis. This free tendon graft was passed through the patella tendon, each end brought up over the surface of the patella, passed again through the quadriceps tendon and sutured together after emerging, enough tension being applied to hold the fragments together while the knee was flexed. Massage was started on this case in one week and motion in two, with walking in a brace soon after. Motion was nearly complete in a few months, and although continuity of extensor control prevailed through the tendon graft independent of bony union, the latter eventually was complete and function became entirely normal. By this technic the potential irritative dangers of wiring were avoided, the procedure was simple and easily carried out, and I think may well be recommended in this type of case.

Tuberosity Fractures

There is a type of fracture of the upper end of the tibia which involves the integrity of the knee joint and frequently results in great disability. It is sometimes called the fender fracture or bumper fracture from the frequency of its production by this form of injury. In industry similar fractures are common from violence received on the side of the knee while it is rigid under body weight or lifting effort. In the most common and simplest form it results in an oblique line of fracture running nearly in a transverse plane from the side of one tibial tuberosity inward and upward to the middle of the articular surface near the tibial spine. The lateral stress causes an impaction of the cancellous bone and the secondary force through the femoral condyle drives the top of the tuberosity downward and away from the center. Effusion and hemarthrosis of the joint follows and without X-ray the injury may be mistaken for an internal derangement of the knee, which as a matter of fact it is in a way. A persisting varus or valgus deformity will suggest the site of the displacement, but the effusion will in a few days produce enough stretching or relaxation of the collateral ligament to permit bringing the legs into alignment, so that X-rays must be obtained and studied carefully. It is absolutely essential that any but the slightest degree of downward and outward displacement of the joint surface be corrected, for deformity will otherwise be progressive and disabling.

When the impaction is not too solid it is possible by reverse manipulation through the pull of the corresponding collateral ligament to lift the depressed tuberosity up into alignment. The limb must then be immobilized in full extension to maintain this pull and in apparent over-correction. Lateral displacement may be corrected by moulding with the hands or by a padded mallet blow on the side of the tuberosity. If manipulation is not successful, open operation is indicated to pry up the fragment, and in this event it is better to hold it wedged up by a block of bone removed from the tibial crest.

In a more severe form the fracture may traverse both tuberosities and enter the joint, the fracture line forming an inverted T or Y, with the body of the tibia wedging the two fragments apart. Closed reduction even here may be successful, the tibial neck being pulled down by strong traction and the tuberosities moulded back together by a weaving manipulation with simultaneous side pressure. Maintenance of the reduction requires continued skeletal traction and lateral pressure by screw pads. Open reduction and internal fixation may be required, however, but the ordinary plate with short screws gives little security in the soft cancellous bone of the tuberosities and spreading of them may not be avoidable save with a long transfixion bolt.

If not compound and if the deformity is reducible, fractures of the tibial tuberosity may still permit recovery with preservation of good joint function. Organization of hemorrhage and exudate may result in fibrous adhesions around the alar ligaments and infrapatella fat pad, but these will either stretch gradually with physiotherapy or can be freed by brisement forcé. However, in the convalescent care it must be remembered that union of bone fragments is fibrous only for several months and that unprotected weight bearing may bring about recurrence of deformity. Motion should be started in 4 to 6 weeks, but lateral stress must be prevented even when weight bearing is not allowed by a carefully fitted corrective brace. The design of the latter is particularly important if varus deformity has to be controlled, and, save for the long slender limb, it must include a pelvic band. A properly designed and fitted brace will enable weight bearing to be transmitted through one side of the joint only. Active function with protection will prove the most potent stimulant to complete repair.

Summary

In the foregoing pages the more common disturbances of knee joint function arising on a traumatic basis, and the program of management of each has been outlined. While little has been introduced in the way of original contribution to the subject, a stimulation for this type of presentation has arisen out of a conviction that the outstanding methods and the systematic approach to the problem that are utilized with such gratifying results in many quarters should become more universally applied. As a final thought, the writer would like to stress the stimulation of recovery that arises from properly regulated functional activity, and the rôle of physiotherapy (which term in this connection does not mean lights or electricity) therein.

XUM

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EDITORIALS

For the last few months, many of us have had our incomes reduced and our positions threatened, because of the serious curtailment in hospital and school expenses, and those of us who are not associated definitely with institutions find ourselves embarrassed financially. If the situation is grave for ourselves, is it not more serious for those who need our ministrations? In the long run, can the curtailment in services be justified? Unless the situation is taken in hand, may we not anticipate, in the next few decades, an aftermath from physical neglect, comparable to that which follows wars?

It is interesting to note that many public spirited individuals are cognizant of the fact that the physical life of our children, especially, must not be neglected. Recently, The National Committee on Physical Education has been organized with Jesse F. Williams, M. D., of Teachers College, Columbia University, as Chairman. To quote from the circular of that committee: "In this period of unprecedented social and economic adjustment, laymen are asking educators to eliminate non-essentials and 'frills.' It is not that people have lost faith in modern education but that some retrenchment in educational expenditures has become imperatively necessary. One of the fields most frequently questioned is physical education. Is it non-essential, or is it indispensable? In attempting to solve this serious problem, it is important not to abandon services which may for the moment appear as non-essential, but which are in fact of an indispensable character."

The first argument of the committee for the maintenance of physical education is as follows: "Human vitality is partly hereditary and partly developmental. The power of vital organs is therefore dependent upon the developmental physical activities of the young. In a sedentary and industrialized society physical education is peculiarly indispensable for the development of the vital organs of children and for the adequate functioning of these same organs in adults."

The National Committee on Physical Education has emphasized that part of physical education in which we as physical therapists are most interested. It has also set us a pattern of conduct. Some school systems are asking for the particular curtailment of corrective physical education, and hospital boards are asking the directors to eliminate non-essentials and "frills.' In our local communities, we of the American Physiotherapy Association must prove the indispensable character of our work, and we must call upon our national organization for backing. —J. L. R.

Convention News

The twelfth annual convention promises to keep up the excellent standards set in other years in other cities. Because it is the year 1933 just a few days after the Century of Progress has opened its gates, and by virtue of unusually low transportation rates and the accessibility of Chicago, the inducements are hard to decline.

Let us repeat a few of the facts just to jog your memory.

1. The dates are June 14, 15, 16, 17, at Chicago.

2. The A. M. A. meets June 12, 13, 14 at Milwaukee, only an hour and a half ride from Chicago. It will be possible to attend the open sessions of the A. M. A. and reach Chicago in time for the opening of convention Wednesday afternoon.

3. The headquarters of convention will be the Knickerbocker Hotel, overlooking beautiful Lake Michigan, within walking distance of down town and only a few moments ride to the "Century of Progress." We have every promise of the finest accommodations and best service a hotel can give. The rates are $4.00 single and $5.00 double per day.

4. Transportation rates are inviting. Round trip tickets on all railroads are specially priced. Make inquiries at your local ticket office. There are no special convention rates, but the Century of Progress fares are unusually low.

The program is now completed and we offer it to you.

The convention committee has asked us to stress that the banquet will be informal, so don't be discouraged if you own only a pre-depression evening gown. We are trying to make our tastes conform somewhat to the times.

Cards are now being mailed to you for reservations and it is most important that these be made early. Put your card in a conspicuous place and send it in as soon as you know your plans. Because of the crowded conditions which are sure to prevail, early reservations will assure us of sufficient rooms and better choice.

We are expecting a record attendance. The Century of Progress has cost many millions of dollars. The Travel and Transport Building alone is more than two blocks long and has the largest dome ever constructed by man.

Plan your vacation at once and send in your card. Chicago invites you to share her glorious Fair and the Chicago Chapter will welcome you to what we hope to be the largest and most worth-while convention.

Tentative Program American Physiotherapy Association June 14, 15, 16, 17

Wednesday, June 14—P. M.
4:00 Tea
8:00 Address of Welcome. Dr. Edwin W. Ryerson, M. D.
The Personality of the Handicapped Child, Dr. Paul L. Schroeder, Director Institute for Juvenile Research.
Hyperpyrexia, Dr. John R. Merriman, M. D.
Thursday, June 15—A. M.
9:00 Business Meeting
12:30 Officers Luncheon
P. M.
2:30 Address by members of the American Physiotherapy Association (to be announced later)
8:00 Address, Dr. John A. Lapp, Ph. D.
Address, Dr. Earl Carlson, M. D.
Rehabilitation of the Speech of the Spastically paralyzed, Dr. Robert West, Ph. D.
Friday, June 16—A. M.
8:30 Trip to Christopher and Spalding Schools
12:30 Luncheon
P. M.
3:00 Business Meeting
7:30 Banquet (Not formal)
Saturday, June 17—A. M.
9:00 Business Meeting

Convention Exhibits

The scientific and commercial exhibits at the last two conventions have created much interest and were indeed a credit to the contributors.

This year we need, more than ever, the help such exchange of ideas can give us. Let us make the 1933 Convention 100% in exhibits—each chapter, and members at large contributing material of some kind—films, photographs, charts, models of equipment and departments. Exhibit your cherished and tested ideas in some way.

Address all comunications referable to exhibits to—Miss Jessie H. Stevenson, 2407 East 72nd Street, Chicago, Ill.

Western Section Convention

The Southern California Chapter is to be hostess to the Western Section of this Association April 28th and 29th. They are planning a splendid program. Members please make reservations for the luncheons and dinner through Chapter Presidents or directly to Miss Susan Roen before April 20th. Miss Roen, who is Program Chairman of the Southern California Chapter, will also answer inquiries concerning hotel rates. Her address is 2423 South Hope Street, Los Angeles.

Friday, April 28, 1933

9:00 A. M.—Registration. Orthopedic Hospital School, Los Angeles.
9:30 A. M.—Orthopedic Hospital School.
Susan G. Roen—Department Head.
Demonstration of Hydro-Gymnasium.
Other demonstrations in the Clinic Building.
"Discussion of Equilibration Exercises"—Dr. C. L. Lowman.
"Demonstration of Turn Buckle Jackets for Scoliosis"—Dr. R. L. Carroll.
11:30 A. M.—Luncheon—Orthopedic Hospital School.
1:00 P. M.—Los Angeles County Hospital.
Margaret Blake—Department Head.
Demonstration,—Fracture Treatment.
Nerve injuries
3:30 P. M.—County Health Center Physiotherapy Unit, —Alhambra. Mrs. Roether.
7:00 P. M.—Dinner—Informal.
A real "get together" and discussion of the problems of our Association. Discussion of the Constitution and proposed changes. Very important.

Saturday, April 29, 1933

8:30 A. M.—Children's Hospital—Los Angeles.
Lily Graham—Department Head
Demonstrations—
Posture
Osteomyelitis—quartz light treatment
Spastics—physiotherapy and occupational therapy
"Body Mechanics"—Dr. Vernon Thompson.
"Spastics"—Dr. Steele Stewart.
10:30 A. M.—Children's Hospital—Los Angeles.
"Physiotherapy in the Los Angeles City Schools"Mrs. Sarah Colby.
"Observations on the Physiotherapy Treatment of Certain Selected Cases"—Florence Burrell, Hazel Furscott.
1:00 P. M.—Luncheon at Hotel Huntington—Pasadena.
Short business meeting.
Tour of Antoinette White's private physiotherapy offices.

CATHERINE A. WORTHINGHAM,
Chairman, Western Section Convention.

Due to the stress of the times and the proximity of Chicago it has been considered wise to omit the sectional meeting on March 30-April 1 of the Eastern Chapters. We are therefore looking forward to a 100% attendance of each chapter at the national convention! It is by meeting our fellow members, healthy discussion and sincere coöperation that our association will continue to grow and prosper.

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The American Congress of Physical Therapy has affiliated with the American Physical Therapy Society retaining the former name intact. They recently decided on the policy of four national divisions, each division to have a one day meeting in April in the city convenient to the members of that locality. Doctor Harold M. F. Behneman of San Francisco has been named chairman and Doctor John S. Hibben of Pasadena, secretary of the Western Division. They will meet at Del Monte, April 23rd, at one-thirty in the Tower Room of the Hotel. The speakers will be recognized workers on the Pacific Coast and approximately eight papers will be given. An invitation is issued to the members and friends of our organization who may be interested.

XUM

Abstracts

By John S. Coulter, M. D.

Fibrositis and Muscular Rheumatism. Charles W. Buckley, M. D., M. R. C. P., Physician, Devonshire Hospital for Rheumatic diseases, Buxton; The Practitioner, cxxx:1:29, January, 1933.

TREATMENT

In the acute forms of muscular rheumatism it is essential to keep the affected parts at rest. In lumbago this means bed, and in the case of other parts, especially the shoulder, recovery will be quicker and more complete if a few days' rest in bed are taken. It will be as well to administer a brisk purge to clear the bowel of toxic products, and a light diet is indicated while in bed. Locally, heat in some form is the most effective remedy. With these methods the various salicylate liniments can be combined with advantage.

Strapping the painful part firmly with adhesive plaster is in many cases a most useful procedure and enables the patient to get about sooner than might otherwise be the case, though it interferes with the application of other remedies.

When, as is frequently the case in women of middle age, there is evidence of defective metabolism, thyroid is often useful and may sometimes be combined with iodine advantageously.

While the same general principles will apply in chronic muscular rheumatism, other measures will also be required. Radiant heat, such as the leucodescent lamp, may be used, if available, but infra-red rays from their power of penetrating more deeply are generally more effective. Simple apparatus can now be obtained for the application of these rays, generated either by gas or electricity, and will be found a useful adjunct to the practitioner's armamentarium, especially in towns and villages where such methods of treatment are otherwise unobtainable. Diathermy may be tried, but has not yielded striking results in my own experience, though if it is desired to heat up the deeper parts it is the best means we have for the purpose. Ionization with salicylate of sodium often gives relief to pain and stiffness. Massage is of the greatest value and should be started as early as possible, but at first only very gently. Fibrous nodules should be searched for and receive special attention; skill and intelligence will produce much better results than mere rubbing, and in the absence of a trained masseur, the doctor will often find it worth while to give a little massage himself since the painful nodules will be more readily apparent to his educated fingers.

A primitive method which often gives much relief and is available in almost any case, however limited the means of the patient, for the treatment of lumbago, is ironing the affected muscles with a hot flat iron applied over a layer of thick brown paper. It is idle to expect results from one or two applications of massage, and if the treatment is not thorough another attack will be likely to occur sooner or later. As the condition improves, gentle active and passive movements may be tried. While there is often no need for this, it is essential in the case of the shoulder, as the mischief so frequently implicates the bursae with resultant spasm, formation of adhesions and a stiff shoulder which may not yield for many months. Therefore, in such cases, the arm should be gently put through a full range of movements twice or three times a day, but not more, or additional inflammation may result.

DIET

Diet should be regulated to avoid excess in any direction. There is some evidence that restriction of carbohydrates is helpful where there is a general tendency to fibrositis, which is often associated with a high blood-sugar. A sufficiency of uncooked fruit and vegetables to provide ample vitamins B and C is important, but it is to be noted that some people get aches and pains after acid substances such as vinegar, acid wines and some fruits.

Vaccines may be useful where there has been a difinite focus of infection, but are less often needed than in other rheumatic conditions.

Injuries to the Internal and External Lateral Ligaments of the Knee—A Conservative Method of Treatment. Frank G. Murphy, M. D., Chicago, in Jour. A. M. A., 99:24:1994, Dec, 10, 1932.

TREATMENT

Immobilization is the first and most important measure, and the application of pressure to prevent further swelling is the next important step in the acute stage. This can be accomplished with a basket splint, a moderately tight bandage over padding and the elevation of the leg above the plane of the body. In simple rupture of the internal lateral ligament the torn edges can be approximated by simply abducting the tibia on the femur to its normal position, in extension.

The lateral ligaments, being composed of fibrous connective tissue, do not contract when ruptured. On the contrary, the torn edges fall together as soon as effusion subsides. Healing takes place by organization and scar tissue formation, which causes a firm union. The position of extension to 180 degrees is strongly recommended here for several reasons:

1. The edges of the ruptured ligament itself can be approximated.
2. The patient can be made ambulatory, thus avoiding weeks of helplessness in bed.
3. Constant use of the leg immobilized at the knee promotes circulation, prevents atrophy and hastens convalescence.

When the swelling subsides the leg is immobilized in a skin-fitting plaster casting extending from the groin to the toes. No padding is used, and the cast is firmly and accurately molded to the leg as it is setting. A walking iron of the Bohler type is incorporated in the case and the patient encouraged to walk. During the first ten days the thigh undergoes some atrophy, the cast becomes loose and may fail to immobilize the knee entirely. To overcome this, a wedge of the cast, base upward and apex toward the knee and of a width corresponding to the shrinkage in the thigh, is removed. The lateral edges of the cast are then forcibly approximated and the whole enclosed with a few rolls of fresh plaster. The cast now again snugly encloses the thigh. This process can be repeated at a later date if more atrophy takes place.

The duration of cast application differs according to the severity of the rupture. In mild cases the cast should be on for not less than six weeks. In more severe cases with absolute rupture of the ligament and extension into the capsule on either side, healing will necessitate use of the cast for ten or twelve weeks. During this time

the patient is allowed to walk by means of the U-shaped walking iron. The heel of the opposite shoe must be raised to allow for clearance of the iron.

After-Treatment.—When the cast is removed, flexion in the knee is limited to a few degrees but the lateral mobility has disappeared. Over the site of the injury there is felt a somewhat boggy and slightly swollen area, probably due to the healing process. On gentle passive lateral force no pain is felt and lateral motion is not present, but if this force is greatly increased, there is felt some pain. Stretching of the newly healed tissue may allow a small degree of movement. Gentle active movements are now allowed. The patient is warned against any possible slip which can easily cause injury to the newly formed tissue.

Strength returns gradually with use. To restore flexion in greater range massage and other physical therapeutic measures may be instituted. However, in my experience, with the exception of a case of hypertrophic arthritis, the undesirable sequelae of stiffness in the knee has not been encountered for a period of longer than from eight to ten weeks.

Periarthritis of the Shoulder. An Analysis of Two Hundred Cases. James A. Dickson, M. D., and Edward H. Crosby, M. D., Cleveland, in Jour. A. M. A., 99:27:-2252, Dec. 31, 1932.

TREATMENT

The treatment of periarthritis of the shoulder has been approached from two angles—general treatment of the patient and local treatment of the shoulder.

The general treatment consisted in removal of all foci of infection, in the teeth, tonsils and prostate, and in every way attempting to bring the patient to a normal state of metabolism. The importance of treating the general metabolic condition of the patient was strikingly emphasized during the observation of several cases of periarthritis of the shoulder in patients who were being treated for severe hyperthyroidism. The results of treatment of the local condition in the shoulders by the various forms of physical therapy and the preoperative regimen, which included complete rest in bed and the administration of compound solution of iodine, were extremely disappointing, and the patients failed to manifest anything but mild improvement. On the other hand, after thyroidectomy there was almost invariably extremely marked relief of the joint symptoms within from forty-eight to seventy-two hours. The intense pains subsided rapidly and with further use of physical methods there was a complete return to normal function. Both hyperthyroidism and hypothyroidism have been encountered in our series of cases; the first was treated by operation and the latter with thyroid extract. Coincident hyperglycemia has been corrected by means of a typical diabetic regimen. Dietary regulation was insisted on and unless contraindicated the patients were give a high vitamin, low carbohydrate diet. Heliotherapy has proved extremely beneficial. Several of our patients showed little improvement with local measures until they acquired a coat of tan.

The local treatment has varied somewhat according to the severity of the symptoms, but the following is a typical regimen to which our patients are subjected. During the acute stage with severe pain and possibly muscle spasm, rest of the shoulder, preferably in bed, is advised. Traction is applied both above and below the elbow and the arm is fixed in moderate abduction and external rotation. As the acute symptoms subside the arm can gradually be brought to the degree of abduction desired. We have found that the position of full abduction and external rotation recommended by many has no particular advantage and is likely to add to the patient's discomfort. Ice caps are applied to the shoulder. Cold applications are more efficacious in the acute stage as any form of heat seems definitely to increase the pain. On the third day sedative diathermia is given and the arm is passively moved (once only) through the full range of abduction and internal and external rotation and is then fixed again in the original position. This treatment must be carried out cautiously, for if motion is started too soon it increases the reaction about the joint. On the other hand, if the arm is kept too long in fixation the exudate becomes organized with the formation of adhesions. The foregoing treatment is carried out daily and voluntary contraction of the deltoid and other muscles is encouraged to the point of pain. The voluntary exercises are facilitated by using the traction apparatus instead of a cast. These movements are beneficial while movement beyond this point, either active or passive, is detrimental. In the subacute cases the arm is protected on an abduction splint, and the patient is given treatment with diathermia, usually on alternate days, and voluntary exercises are encouraged daily.

As the range of voluntary movement without pain increases, the degree of passive abduction is gradually increased until full active abduction is possible without discomfort. The abduction splint is then discarded and full voluntary movements are encouraged until full function is restored. We agree with Hitzrot and Haussling that if the acute cases are properly managed much of the prolonged treatment necessary could be greatly minimized.

In 1923 one of us reported satisfactory results with diathermia in periarthritis of the shoulder, and similar experiences were reported by Mumford. If, with the aid of diathermia and active and passive stretching exercises, there persists limitation of range of motion in the joint, manipulation of the shoulder under anaesthesia should be seriously considered. We agree with Perkins that the most satisfactory results from manipulative treatment are obtained in the group of cases due definitely to trauma (not included in this series). However, manipulation has a definite place in the treatment of selected cases of the group under consideration. When the acute symptoms have subsided and the general treatment is adequate, if limitation of range of movement persists on account of strong adhesions which have formed, a great deal of convalescing time can be saved for the patient by breaking these adhesions by manipulation. Under nitrous-oxide anaesthesia the shoulder is manipulated deliberately and gently. We always keep in mind that we may be dealing with marked atrophy of the bone structures and very dense adherent bands and care is taken to prevent dislocation or fracture. For this reason leverage grips are used. The point is to break the adhesions completely and to avoid causing any more reaction about the joint than is absolutely necesary. The arm is forced through full abduction, internal and external rotation and fixed in abduction with traction.

The Sciatic Syndrome. Walter P. Gardner, M. D., Saint Paul, in Minnesota Med., xvi:1:36, January, 1933.

Rest in bed, heat and analgesic drugs may be sufficient to allay the pain. If such procedures do not suffice, recourse to sacral epidural injection should be had. This consists of the injection of from 60 to 100 cc. of sterile normal saline into the sacral epidural space.

The principles governing the treatment of neuritis elsewhere dictate the care of sciatic neuritis, namely, rest, heat and the relief of pain. In the case of sciatic neuritis, this means rest in bed, preferably with the affected

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limb wrapped in sheet wool. Diathermy from the lumbosacral region to the toes gives a moderate heat throughout the course of the nerve, and along with galvanism is of value in moderately severe and acute cases. In chronic cases, injection of 50 to 100 cc. of sterile normal saline following immediately a preliminary injection of 2 cc. of two per cent novocain within the nerve sheath gives a good result in most cases.

In those instances where this symptom complex is felt to be due to myositis or fibromyositis, physical therapy is the choice. We must not lose sight of the fact that in the subacute and chronic cases of this type the most likely underlying basis is focal infection, and all foci of infection must be adequately treated.

Titus has reported the results of observations in over 600 cases which he feels belong to this group. If the case is an acute one, treatment is commenced with radiant light for the purpose of inducing a hyperemia. When this object has been attained, static breeze is employed, and, as improvement occurs, static wave and sparks are used finally. In subacute and chronic instances, diathermy through the pelvis in the region of the sacro-sciatic notch is employed, followed again by the use of the static electricity. Sinusoidal current may be substituted for static electricity if the latter is not available. Deep heat is thus secured, plus the decongesting and muscle stimulating effect of static electricity. Diathermy to the entire course of the nerve and galvanism as well, are useless here. Massage also is of little value.

In milder and more recent cases, rest in bed, physiotherapy and analgesics, with immobilization by adhesive plaster strapping may suffice. In the more severe and less recent cases, more extensive procedures may be required.

Putti prefers a method which brings about complete immobilization gradually and uses heat as an adjunct. He gives a hot air bath at 90 to 125 degrees for one-half hour daily, to produce an hyperemia. As soon as the pain will allow the patient to stand without great discomfort, immobilization is secured by a plaster jacket, which gives fixation to the pelvis and trunk, except the shoulders. He emphasizes the fact that this jacket must immobilize only and not attempt to correct the scoliosis present. The cast is left on the first day only long enough for the plaster to dry, is then bivalved and removed. It is worn for an increasing period of time each day, until in about ten days it can be worn by the patient continuously. After two to three months it may be replaced by a corset, which is worn up to a year.

Immobilization may be secured by following a different plan of procedure which is well described by Kleinberg, who, however, feels that sprains of the sacro-iliac and lumbo-sacral joints are more common causes of the sciatic syndrome than is arthritis of the intervertebral foramina. Certainly the method is of equal value whether one attributes the symptoms to the joint strain or to a neurodocitis resulting, if it does, from such a strain. This form of therapy should be restricted to those chronic resistant cases with "fixed" scoliosis. It is designed to break up all adhesions between the lumbar muscles and between the lumbar vertebral articulations, and to immediately correct the deformity as well as to secure immobilization. Briefly, it consists of manipulation, under anaesthesia, of the lumbar spine from side to side, followed by hyperextension of the lower limbs until the flatness of the lumbar portion of the vertebral column referred to above is replaced by the normal concavity. A spica cast, which includes the painful limb, then is applied, thus securing immobilization of the spine and affected limb. In some cases before applying the cast and following manipulation of the spine, Kleinberg uses forceful stretching of the sciatic nerve, by forcefully flexing the affected lower extremity (with the knee extended), until the leg can be brought to within fifteen inches of the face. This particular portion of the treatment is in general not held in high repute and for the most part has been discarded. It involves of course the danger of causing traumatic rupture of the sciatic nerve.

The cast is left on for three weeks, at the end of which time it is temporarily removed, and the patient measured for a Knight spinal brace. Physiotherapy in the form of heat, gentle massage and graduated exercise of the extremity and back muscles is then begun, and in ten to fourteen days, with brace applied, the patient is able to begin walking. With continued physiotherapy the individual is said to be able to return to his work about six weeks after he begins to walk.

The Management of Acute Thrombo-Phlebitic Edema. Geza de Takats, M. D., Chicago, in Jour. A. M. A., 100:1:34, Jan. 7, 1933.

1. The Hydrostatic Factor.—It is common knowledge that dependent edema, whether cardiac or phlebitic in origin, may be reduced by the horizontal or the elevated position. But the elevation is usually slight and consists of a few pillows placed under the knee. A real elevation is effected either by suspending the limb or a Balkan frame or by placing it on an adjustable wooden splint, which can easily be made in any hospital. If this is properly padded, it will produce no discomfort to the patient and should be maintained as long as the edema persists. If after the horizontal position has been assumed the edema reappears, the elevation is continued.

An electric cradle, such as the one shown, which was made in the department of physical therapy, may be used in combination with the splint. Some patients, however, whose limbs are hot and throbbing, object to the use of dry heat. In such instances, towels moistened in 33 per cent alcohol and covered with a rubber sheet are very comfortable and seem to diminish the inflammatory reaction. If the skin is protected with petrolatum, the dilute alcoholic dressing will not macerate it.

2. The Diet.—It has only been recently recognized that fluid and salt restriction have real value in combating surgical edemas. The fluid intake is restricted to 20 ounces (600 cc.) in cases of thrombophlebitic edema and maintained below 32 ounces (950 cc.) with a dry diet for three months after the edema has subsided.

3. Drugs.—The most active dehydration can be accomplished with mercury diuretics, notably salyrgan. This is given in an initial dose of 1 cc. intravenously and should be repeated every third or fourth day in 2 cc. doses until the edema disappears.

4. Exercise and Massage.—The patients are kept in bed, but with permission to turn on the side and sit up with a back rest for ten days after the temperature and the pulse have returned to normal. Then very mild stroking massage of the foot and calf is begun for not more than five minutes; the evening pulse and temperature are watched for a possible reaction. If the pulse, which is the more sensitive of the two, becomes more rapid, the massage is discontinued. Otherwise, the five minute massage is given daily for a week, gradually increasing in intensity. The next week a ten minute massage is given, but never higher than the knee. For those who abhor the idea of massage in venous thrombosis, it may be said that the clot in the iliac or femoral vein will not be mobilized by stroking massage of the calves. Naturally, in case of inflammatory reaction, no massage is permissible. The third week the patient may hang his

foot down over the side of the bed, and dorsal and plantar flexion of the foot are prescribed for five minutes three times a day. The fourth week after the pulse and temperature have become normal the patient is allowed to be out of bed for gradually increasing amounts of time. The affected limb, which should not be edematous at this time, is supported with a light elastic stocking. This is worn for an arbitrary period of from three to six months. If there is a swelling of the ankles at the end of the day, the patient must elevate the limb during the night and should start out in the morning without edema.

It is seen from this outline that the arbitrary period of six weeks' immobilization after a deep thrombosis has been abandoned, and each patient is treated according to the rapidity with which the pulse and temperature return to normal.

The General Care of Peripheral Vascular Diseases. Mont R. Reid, M. D., Cincinnati, Ohio, in Ann. Surg. xcvi:4:733, October, 1932.

It is often a difficult matter to make a patient realize the importance of the many precautions and details of treatment that should be observed; it is still more difficult to make him use them constantly and intelligently. Fortunately, almost every patient can be made to understand the reason for the things he is advised to do if only the doctor will take the time and patience to explain. The treatment of peripheral vascular lesions becomes effective only when there is complete cooperation of the patient.

The early adoption of a routine care and the simpler treatments would make unnecessary many amputations; many patients who now lose extremities would live out their lives without serious or tragic peripheral handicaps. The routine examination of all peripheral vessels would result in much earlier diagnoses; the true nature of many cases that are now treated for weeks, months and years for pain, fallen arches, and cramps would be established. If it were the rule to record the pulse from an examination of the pedal rather than the wrist pulses many more cases of early vascular trouble would be detected.

It is important to determine the level of a resting extremity, which will result in the optimum circulation. A little reflection on the various grades of peripheral vascular deficiency makes it obvious that this optimum level must be determined for each individual case. The actual force behind the blood circulating through the peripheral arteries is subject to a wide variation; it is probably never identical in any two cases. A fairly accurate idea can be determined by the use of the Pachon oscillometer but this instrument is unfortunately at the disposal of very few doctors. A less accurate but practical idea of the level of optimum circulation can be obtained from observations on the fullness of the veins when the extremity is put at different levels with respect to the level of the heart. A foot that is allowed to hang over the side of the bed may become congested and cyanotic and the veins of it markedly distended. The effectiveness of the feebly circulating blood becomes reduced by the back-pressure of the venous blood and the tissues of the foot suffer a reduced nourishment. If, on the other hand, the foot is elevated above the level of the heart it becomes blanched and cadaveric in appearance and its veins become collapsed, usually appearing as grooves in the skin. The weight of gravity of the column of arterial blood is seriously reducing the amount of blood that can be forced into the capillary bed and the tissues suffer a reduced nourishment. In the one instance it is the back-pressure of the venous blood that is harmful; in the other it is the back-pressure of the column of arterial blood. Somewhere between these two extremes is to be found the point of maximum circulation and consequently the greatest nourishment of tissues. We believe this point to be at the level where the veins are neither collapsed nor distended, when they are visible and apparently on the same level with the surface of the skin.

This can be determined by the slow elevation of an extremity that has been allowed to hang down until the veins become fully distended. At a certain point, usually three to six inches below the level of the heart, the pressure within the veins can be seen to give way suddenly. Near to the point of this observation they will assume a capacity that neither distends nor retracts the skin. This is an observation that the patient can make and in which he takes great interest. Once the level of optimum circulation has been determined and the patient made to realize its importance he will usually endeavor to place his affected extremities at the best level whenever they are at rest. Many of my patients try to observe this position of optimum circulation whenever they are sitting or lying down—in the library, office and at the dining table, on the couch and in bed.

It is usually easy to demonstrate to a patient the value of a certain amount of exercise whenever infection and gangrene are not a contra-indication. Voluntary movement of the ankle and toes will often cause a striking improvement in the color of the affected foot that has been allowed to hang until it becomes red and cyanotic. We make our patients stand for a few minutes and then observe for themselves the improvement which comes with movement of the toes and ankles. The congestion is usually accompanied by a subjective sensation of tingling or tightness. With this knowledge the cooperative patient will always move his toes and feet whenever he experiences this sensation. He soon learns that it comes most often when he stands or sits still. The harm of too much exercise and the meaning of the pains of intermittent claudication should also be explained.

In our experience it is best to require a short period of hospitalization in order to teach patients, when indicated, to carry out accurately the valuable exercises of Buerger and Allen. The cycles of these exercises in which time is devoted to heat, dependency with exercise and elevation are, of course, familiar to everyone. They should be a most important part of the routine of the patient's self-help. In addition to their unquestioned value they make the patient conscious of the care and duty he owes himself.

Careful washing and greasing or oiling of the skin should be persisted in until it becomes as nearly like a child's skin as it is possible to get it. In the beginning of treatment this may necessitate treatment of the skin twice daily until the calluses and thickened conified epithelium disappear. It does not seem to matter much what lubricant is used; we usually employ cocoa butter or lanoline and insist that it be rubbed into the skin until it seems to disappear. It is surprising how much enthusiasm the patient will take in the care of his skin if he fully understands its importance and gets the proper recognition of his efforts.

Woolen socks with or without fleece-lined shoes should be insisted upon until the feet perspire, feel uncomfortably warm subjectively and definitely warm objectively.

There do not appear to be any harmful effects from over-heating. On the contrary, it is our belief that sweating of the extremities is a good thing, not only to improve the delicacy of the skin and the inflammatory processes beneath it, but to help the actual nourishment of the tissues. It is scarcely necessary to stress the seriousness of wounds and infections of the extremities in

association with peripheral vascular disease; it is well appreciated.

In view of the uncertainty and contradictory evidences of the harmful effects of tobacco, it has become our policy to discontinue its use whenever it can be done.

SUMMARY

In the management of peripheral vascular diseases it is of the utmost importance to secure and maintain the interest and active cooperation of patients. Fortunately, most of the therapy is reasonable and easily understood if only the time and patience are devoted to explaining its significance.

The position of maximum circulation of the affected parts when at rest should be determined for each case. A simple method of determining this position is described. Too much elevation more effectively reduces nourishment and more frequently causes gangrene than does too much dependency.

The effect of cold is evident from the high incidence of complications during the winter months. The affected extremities should never be allowed to become cold. Moderate sweating improves the texture of the skin and the nourishment of the tissues beneath it.

By means of baths, oils and greases the skin should be made as soft and delicate as possible.

The most trivial wounds and infections should be treated as major complications until they are completely healed.

Any form of trauma to inflamed or diseased vessels should be avoided by both the patient and doctor. The possible dangers of the tourniquet and blood pressure apparatus are discussed, as well as certain forms of exercise and passive massage.

In order to teach patients the Buerger or Allen voluntary exercises a short period of hospitalization is probably desirable.

Amputations performed between two tourniquets for gangrenous and infected extremities probably reduce the incidence of infection of the stumps. If, for fear of damage to tissues and blood vessels, the use of a tourniquet is contra-indicated, the distal tourniquet alone may be used.

The fluid intake should be established and maintained on a high level.

In some instances the use of thyroid extract may help to improve the circulation.

All foci of infection should be eliminated.

It is our policy to advise abstinence from the use of tobacco and alcohol.

The routine examination of all peripheral pulses would result in earlier diagnoses of peripheral vascular diseases and would make possible the avoidance of many complications which are so frequently the direct cause of amputations.

Carbon Dioxide Baths in Cardiac and Circulatory Disorders. Robert Baumstark, M. D., and Theo. Deglmann, M. D., Hamburg, in The Practitioner, cxxx:1:90, January, 1933.

From what has been said it will be seen that hard and fast indications and contra-indications for carbon dioxide baths cannot be scheduled; rather must lines of treatment be based broadly on theoretical considerations and practical experience, with the necessary adjustments made to suit the individual case. The prescribing of one or more carbon-dioxide baths must depend on the actual state of the heart. In an oft-quoted phrase, these baths are described as "the heart's gymnasium" (Schott), and just as gymnastics require a considerable reserve of physical strength, so does the carbon dioxide bath tax the reserve forces of the heart. If the heart cannot withstand the strain, there follows an alteration of the blood distribution in the organism—that is, cardiac failure. The chief therapeutic use of carbon-dioxide baths is in cardiac conditions in which the blood distribution in the organism has not been affected. This category includes (1) compensated valvular disease, (2) mycardial affections with arrhythmia or abnormal electro-cardiograms, and (3) essential hypertonus. Any definite sign of cardiac failure contra-indicates balneotherapy, especially if other methods of treatment, particularly rest and drug treatment, have proved ineffective. If the decompensation will not yield to any other treatment, then carbon-dioxide baths a fortiori should be avoided since they may do more harm than good. Patients whose cardiac condition demands complete rest should be kept in bed and not given baths.

Effect of the Weather on Blood Pressure. Sec. of Foreign Letters in Jour. A. M. A., 99:19:1616, Nov. 5, 1932.

That atmospheric changes exert a marked influence on man is universally recognized; but heretofore there has been a lack of scientific information on the subject. As announced in Forschungen und Fortschritte, Dr. Kurt Franke of Halle has made a study during the last four years of the fluctuations in pressure in patients with high blood pressure and in healthy persons under the influence of changes in the weather. His studies revealed that it is not so much the change in air pressure that is important as the shifting of air areas caused by the changing "lows." The invasion of air currents from the polar regions or from the eastern part of the continent generally causes a rise, whereas the arrival of warm Atlantic or sub-tropical air currents effects a lowering of blood pressure. The component of the atmospheric occurrences that influences the organism appears to be based on electric processes.

Massage and Its Application in Heart Disease. Abst. in Jour. A. M. A., 99:21:1814, Nov. 19, 1932, from Arch. f. Verdauungskr, Berlin, 52:238 (Sept.) 1932.

Lampert first discusses the effect of massage in general; namely, the better blood perfusion of the massaged portions of the body, the influence on the minute volume of the heart, the mechanical stimulation of the arterioles and of the capillaries, and the influence on blood pressure, pulsation, the kidneys and diuresis. He reaches the conclusion that massage exerts a favorable influence on the circulation. He further shows in what circulatory disorders massage is advisable. Because massage attacks the peripheral circulation, it is particularly advisable in disorders in which the circulation fails; namely, in collapse and in collapse-like conditions in patients with valvular defects. In these cases, it is necessary to stimulate the flow of the blood to the heart, which can be accomplished by pressure on the veins. Into this group belong the disturbances in the blood distribution, such as occur in some persons in the lower extremities after prolonged standing, or the faulty blood distribution due to disorders in the nervous regulation of the peripheral apparatus, or to incretory disturbances. Massage is likewise helpful in some forms of hypertension, particularly in those instances in which a decompensated valvular defect is combined with peripheral vascular insufficiency. Latent edema is one of the main conditions in which massage should be resorted to, but even in visible edema massage is helpful. However, massage is contra-

indicated in patients in whom the insufficiency is purely of cardiac origin; also in myocarditis, endocarditis and all inflammatory processes of the skin and of other organs (fever). Under no circumstances should massage be done at the site of inflammation. In discussing the technic of massage, the author emphasizes that massage should never be painful.

Effect of Massage on Metabolism of Fracture Patients. Abst. in Jour. A. M. A., 99:19:1640, Nov. 5, 1932, from Quarterly Jour. of Med., Oxford, 1:401, (July) 1932.

Cuthbertson reports that massage supplemented by passive movement, when applied even for twenty minutes a day, to patients convalescing from fractures of the long bones, causes generally, but not constantly (seven out of nine experiments) a decreased urinary excretion, in effect, and increased retention of nitrogen, sulphur and phosphorus. Muscle and bone appear to be the tissues chiefly affected by this anabolic activity.

After-Care of the Injured. W. L. Estes, Jr., M. D., Bethlehem, Pennsylvania, Abst. in Jour. A. M. A. 99:15: 1222, Oct. 8, 1932.

Essentials of After-Care

The acid test of all treatment is the rapid and complete restoration of function, with the return of the patient to his former job. The proper after-care of the injured therefore must include not only (1) early physical therapy, but also (2) active cooperation of the patient in voluntary use of the injured part, and, finally, (3) early return to work—occupational therapy.

1. Early Physical Therapy.—It has been emphasized and stressed since the days of Championniere, and revived recently by Murray and others that following fractures early light stroking massage should be given to the traumatized soft parts as soon as possible after reduction, together with slow, light stimulation of the muscles by the faradic current, such as is obtained by the Bristow coil or a myoneurostat. Daily treatments should be maintained until complete active function is obtained. In other types of trauma, particularly injuries of the joints, some form of diathermy is also useful, and occasionally infra-red rays may be indicated. In the later stages, various forms of mechanotherapy may be added, but they do not have the value of the aforementioned early therapy.

2. Active Cooperation of Patient.—For fractures, traction suspension treatment should be used whenever possible. Early active motion is encouraged, and daily instruction in and test of muscle use should be inaugurated. The plan of treatment is outlined to the more intelligent patient, in order to obtain his cooperation so far as possible, and the importance of his cooperation is stressed. Gain in function is graphically demonstrated. Those with a fear complex or anxiety psychosis particularly need sympathetic and understanding supervision and direction to obtain satisfactory progress, as when this complex is established it is exceedingly difficult to overcome. Early indications of the return of function and of favorable developments in recovery must be pointed out, and if deformity does not necessarily mean disability. "The medical man must try to discover and constantly to recognize the exact mental attitude of the patient. This includes resentment at the injury, apathy, desire for compensation, fear of pain, keenness to get well, etc." (Hertzlet.) His confidence must be gained in the methods and apparatus employed; he must be convinced that rapid recovery of function depends on him, and that physical therapy and massage are but adjuncts to help him help himself. As Murray has so well said, "The psychological side of the fracture problem is beginning to receive attention. More men are being made to realize that the regaining of function is the patient's job, not ours. Our part is that of helping the patient to regain function."

3. Early Return to Work.—If, after function has been somewhat restored in the injured part, a "doubting Thomas" can be put on a job or back on his old job, preferably in the same environment or in the same shop he worked in before, his mind is again concentrated on work to be done; he realizes he is still good for something, and, in the distraction of his thought from his injury—incidental to this work or job—he subconsciously, or unwittingly, uses the disabled member by normal or natural movements incident to work, and obtains quicker recovery of complete function than in simple detached physical therapy. However, whenever necessary, massage, electrotherapy and mechanotherapy can also be continued though the injured man is at work. In other words, a real occupation therapy is substituted for abnormal occupational therapy or physical therapy.

Conclusions

Stress has been laid on the important and essential part the patient and his mental attitude play in the recovery from an injury, but there has been no intent to overlook or to minimize the need for prompt and skilful surgical procedure. Rather, the intention has been to indicate what may be the weak links in the chain of treatment. It has been pointed out that the patient himself must be taught to realize that the regaining of function is his job, and that it can be accomplished by persistent active use of the injured part, aided by physical therapy.

Proper psychotherapy to avoid and prevent the neuroses of injury must be practiced, and early return to work is the best occupational therapy and does much, and, perhaps, most, to effect the complete and final restoration of function.

Occupational Therapy In "Surgical" Tuberculosis. Abst. in Jour. A. M. A., 99:19:1645, Nov. 5, 1932, from Ztschr. f. Tuberk., Leipzig, 65:257, (Sept.) 1932.

Rollier points out that the thought of giving work to bedfast patients, namely, to those with tuberculosis of the spinal column, of the hip or of the upper extremities, appears at first paradoxical, since these forms of "surgical" tuberculosis require immobilization. However, it will become understandable when it is considered to what extent former opinions about the treatment of surgical tuberculosis have been modified by general heliotherapy, for it is the latter that makes occupational therapy possible. For patients in whom heliotherapy has improved the general condition and has developed the muscles, regular work is helpful. The author shows photographs of patients, who, while comfortably bedded in open solariums, are busy making or inspecting induction coils, parts of watches or other small objects. Individualized and carefully controlled occupational therapy, together with heliotherapy, is valuable in three respects: physically, psychically and economically. The physical advantages are that it has a favorable influence on the circulation; it regulates the body heat, and it stimulates metabolism. The psychic influence is especially valuable, in that the working patient no longer feels useless, and thus he regains an interest in life. The fact that with the payment he receives for his work he can repay at least a part of the costs of his treatment has a psychic as well as an economic value.

Tuberculosis of Middle Ear In Adult. Abst. in Jour. A. M. A., 99:10:866, Sept. 3, 1932, from Irish J. M. Sc., Dublin, 75:126, (March) 1932.

XUM

Wilson calls attention to the fact that tuberculous otitis media in adults is usually secondary to tuberculosis elsewhere in the body. The diagnosis rests on the painless onset of a thin mucopurulent discharge, together with marked deafness rather than on laboratory methods. The only nontuberculous cases in which this is likely to occur are those in which there is an old-standing perforation of the tympanic membrane. Multiple perforations of the membrana tympani occur in about one-third of the cases. The chances of recovery from the local condition are fair. Secondary infection by pyogenic organisms completely changes the clinical picture and renders the outlook more serious. When this takes place there is a marked tendency to luxuriant proliferation of granulation tissue. The presence of a tuberculous otitis media indicates a severe infection and justifies a grave prognosis of the general condition. Treatment should be confined to simple cleansing of the meatus and the use of mild antiseptics. It is suggested that zinc ionization might give good results in a series of cases. Treatment of the lung infection is of major importance.

Tuberculosis of the Larynx and Artificial Sunlight Treatment. Sir StClair Thomson, M. D., F. R. C. P., F. R. C. S., Laryngologist to King Edward VII Sanatorium, Midhurst; Emeritus Professor of Laryngology in King's College Hospital, London; British M. J., No. 3750, page 905, November 19, 1932.

Equipment and Technique.—In a comfortable, well-warmed room two couches were arranged with lamps between them, so that two patients could share the light rays at the same time. Communicating with this room was a dressing room, equipped with a douche. The carbon lamps, obtained from Copenhagen, were exactly similar to those used and recommended in the Finsen Institute.

Cases Selected for Light Treatment.—The first light treatment at Midhurst was given on November 18, 1926. The present report deals with cases between that date and 1929, and included all cases so treated during the three years. In these three years, thirty-two cases of laryngeal tuberculosis were selected for trial; sixteen were males and sixteen females. These were chosen as suitable because they were favorable as regards (a) the situation in the larynx, (b) clinical nature of the disease, (c) record of steady temperature, (d) condition of the lungs, (e) satisfactory type of patient, and (f) the indications of favorable resistance.

As evidence of the promising situation and limited extent of laryngeal disease, it was recorded that in no fewer than eleven instances (one-third of the group) there was no change in the voice. The discovery that there was a throat lesion was made owing to our custom of examining the upper air passage of every patient on admission. The laryngeal disease had not caused any voice change, because it had left unaffected both vocal cords and the posterior commissure stretching between them. Complete normal glottic closure had therefore been unimpaired, for in these cases the lesions had occurred above the level of the closed glottis, and consisted generally of limited and often unbroken deposits in the interarytenoid area, or in the region above the vocal processes—very favorable locations.

In all the thirty-two cases the appearances were those of a fairly quiescent type. No case was submitted to light treatment until voice rest (whispers or silence) and the general sanatorium treatment had shown that there was no activity, and that local as well as general conditions warranted the opinion that the case was well within the expectation of cure. Rectal temperature, morning and evening, was first charted for some weeks. Although some supporters of light treatment have recommended its employment even with pyrexia, urging that it would reduce fever, we have never been able to bring ourselves to disregard this valuable symptom as an indication for strict rest and a warning against any activity, physical or mental. This guiding principle was only strengthened by our experience in some of the cases, where each attempt to apply light treatment was checked by the onset of pyrexia. Needless to say, the treatment was never tried with patients undergoing strict (bed) rest.

Results.—The results have caused us much disappointment. We found that the treatment may be harmful, that only in a very small number of cases could any benefit be attributed to it, and that few of the thirty-two patients became enamored of it or were anxious to persevere after an adequate trial.

In the results displayed in figures we have an example of how misleading unanalysed statistics may be. Judged by final result alone a successful case might be made out in favor of light treatment, whereas an analysis of the figures clearly demonstrates what an ineffective addition it is to sanatorium methods.

Condition worse	1
Condition in situ quo	3
Condition improved	4
Condition cured	24
	32

Conclusion.—In thirty-two favorable cases there were no striking evidences of benefit from light treatment; in only two or three might some help from it be claimed. Nor can it be said that healing of laryngeal tuberculosis was hastened, nor that the course of light baths in any way rendered subsequent cure by the cautery more rapid or more certain. Quite as good results have been obtained, and just as swiftly, with voice rest, sometimes supplemented with the galvano-cautery or artificial pneumo-thorax, and, in all cases, the sanatorium regime.

The whole picture of tuberculosis is so remarkably changed for the better under sanatorium conditions that many remedies which appear to be beneficial under ordinary hospital or home conditions are found to add nothing to the improvement wrought by hygienic living in unvitiated air. Hence the number of "negative findings" with many new remedies when tried in a sanatorium. Under other conditions it is possible they may be of help—by suggestion if not otherwise. The constant medical supervision and control available at Midhurst has enabled us to see the possible drawbacks, and even dangers, of light treatment if not carefully and regularly watched. Since the above series was ended in November, 1929, we have continued to try this remedy in well selected cases, and the conclusion still is that, while it may appear to be of help in a very few cases, it probably acts only by suggestion; that it is frought with danger if not scrupulously supervised; and that, on the whole, in patients in a well-ordered sanatorium it is no addition to the treatment now in use.

Erythrodema Psoriaticum, a Review of Twenty-two Cases. William H. Goeckerman, M. D., and Paul A. O'Leary, M. D., Rochester, Minnesota, in Jour. A. M. A,. 99:25:2102, Dec. 17, 1932.

The term erythrodema psoriaticum is used to designate the generalization of psoriasis vulgaris to a point at which the usual clinical characteristics have disappeared and have been replaced by those of exfoliative

dermatitis. Although this phenomenon is not understood in its entirety, its distinctive clinical character as contrasted with other types of exfoliative dermatitis is accepted. This is evidence, however, that even careful observers do not agree on all of its phases. This prompted us to make a complete review of our own material.

In somewhat more than 2,200 cases of psoriasis seen at the Mayo Clinic we were able to find 22 typical cases of erythroderma psoriaticum, an incidence of about 1 per cent.

Apparently the results of treatment of erythroderma psoriaticum by rest and various soothing measures are fairly satisfactory when continued over a considerable period. In our experience the treatment by crude coal tar and ultraviolet rays was definitely superior to the measures we formerly employed. There is no way to predict the future course of the disease after disappearance of the erythroderma. In most cases the ordinary course of psoriasis evidently is retained; in some cases other attacks of erythroderma will appear in the future, but there is good evidence that in an occasional case the patient may remain practically free from trouble for years.

The Modern Management of Acne Vulgaris. Norman Tobias, M. D., St. Louis, in J. Missouri M. A., 30:1:17, January, 1933.

The importance of acne vulgaris to the general practitioner lies in the fact that the disease while not serious from the standpoint of its pathology is of great importance to the young patient from the cosmetic and mental angles. Too often the disease is considered a minor affliction and "hit or miss" treatment is administered with commensurate results.

The etiology of acne is unknown. Even the role of the acne bacillus has not as yet been evaluated. It is true that microbic infection cannot be disregarded but a special soil plus the microbic factors are important essentials. Darier has coined the term "kerosis" to describe the pathological effects of this special predisposition or soil which gives the skin the following characteristics: a dirty hue, enlargement of the pilosebaceous openings, a thickening of the skin and a coarse-grained appearance. Kerosis may be a family feature.

Acne cannot be treated properly unless the different types are thoroughly understood.

The Mental State in Acne.—Acne in girls is often associated with a peculiar state of mind which may be styled as an inferiority complex the degree of which depends on the duration and severity of the acne. In aggravated cases patients will shun social contacts, stay at home for days at a time and even give up school. Irritability is often an associated feature. These children become a source of great anxiety to the parents.

Surgical Measures.—Acne surgery is required in those cases characterized by pustule and abscess formation. If these are not treated the patient is left to her own devices and may attempt to open them with needles, etc., which may do more harm than good.

Vaccines.—Personally I have not seen any beneficial results from the use of either straight or combined stock or autogenous vaccines.

Nonspecific Therapy.—Foreign proteins, such as milk, typhoid vaccines, etc., and such drugs as manganese butyrate and the tin preparations have proved disappointing in my hands.

Bacteriophages.—My experience with bacteriophages has convinced me that improvement is only temporary.

Ultraviolet Light Therapy.—There is no specific action in the ultraviolet ray in the treatment of acne. In erythema doses it may produce exfoliation and by so doing can replace local therapy used for this purpose. It can be used in the erythematous and juvenile types of acne where roentgen ray treatment would not be safe. In females with a tendency to hypertrichosis ultraviolet light is not indicated because it may stimulate the growth of superfluous hair.

Local Treatment.—The indications for local treatment are in those cases where roentgen rays are not indicated and in those where sufficient roentgen ray treatment has been used. Ointments usually are not well tolerated except in the seborrheic cases. Lotions containing sulphur and resorcin are at first useful but gradually lose their effectiveness. During the period of roentgen ray exposure it is not advisable to use local therapy except very mild astringents.

Roentgen Ray Therapy.—Only two agents will permanently cure acne—nature and the roentgen ray. It is indicated in about 80 per cent of the cases.

SUMMARY

1. The various contributory factors in acne must be studied and treated in order to prevent relapses.
2. Roentgen ray therapy is the best measure to insure permanent cure.
3. Surgical measures, vaccine therapy and ultraviolet light have their special indications.
4. The importance of diet as a contributory factor varies in different patients. Hyperglycemia is not a constant factor.

Keratoses of the Face and Hands. A Differential Diagnosis Between Precancerous and Benign Keratoses. G. V. Stryker, M. D., St. Louis, in J. Missouri M. A., 30:1:15, January, 1933.

A keratosis is a thickening of the horny layer of the skin. This thickening may arise as a result of internal causes such as that produced by the oral or intravenous administration of arsenic. It may result from congenital and inherited variations in the epidermis, or from an infection of which the gonorrheal keratosis is an example. It may also be produced by the repeated or excessive application of such external agents as coal tar and its derivatives, mineral and vegetable oils, roentgen rays, radium and the rays of the solar spectrum originating from the sun or produced artificially.

The keratoses with which we are especially concerned are localized brown to black, slightly elevated, scaly lesions which occur chiefly on the exposed surfaces of the body.

There are two distinct types, (1) the seborrheic keratoses and (2) the senile keratoses. The importance of these lesions depends upon their precancerous tendencies. The seborrheic keratosis is a relatively benign lesion while the senile keratosis constitutes a true precancerous dermatosis. Emphasis of the salient differential points of clinical diagnosis should render recognition less difficult and lead to proper treatment.

TREATMENT

Uncomplicated seborrheic keratoses are not removed except for cosmetic reasons. When their removal is requested it may be done by freezing with solid carbon dioxide, destruction by the coagulation current or by simple excision.

Senile keratosis, a true precancerous lesion, should be treated before malignant changes occur. Hertzler has said that "more patients present themselves in this clinic hopelessly sick with malignancies, the result of neglected or maltreated simple lesions of the skin, than from cancer of the uterus or mammary gland or the lip."

The agent employed may vary but whether it be ex-

cision, coagulation or radiation with radium or roentgen rays, the lesion must be entirely destroyed and a sufficient amount of surrounding tissue included so as to forestall a recurrence and subsequent activation.

The Physical Therapy of the Commoner Skin Diseases. Howard J. Parkhurst, M. D., Toledo, Ohio, in Jour. Michigan State Med. Soc., xxxi:12:796, December, 1932.

Ultraviolet is of some importance as an agent in cutaneous therapy, but unfortunately its value in the treatment of many conditions seems to have been sadly over-rated. So far as we know at present, it does no permanent damage to the skin. But these views may have to be revised in the case of its protracted use, over a period of years, for it is entirely possible that potentially premalignant keratoses may ultimately develop, as in so-called "sailor's skin." However, in dermatology such prolonged exposure is rarely needed.

Electrodesiccation, in which the monopolar high frequency current is employed with an ordinary small sewing needle as the electrode, is very useful for the removal of small growths, if properly handled. In my hands, it has almost entirely replaced solid carbon dioxid and trichloracetic acid. Those who would use it are referred to Wyeth's book on the subject. Its chief dangers lie in the employment of too strong a current or going in too deeply. A small needle is usually the best electrode for cutaneous work, and in the removal of warts and moles it is necessary to remember that the needle point should not penetrate deeper than the level of the surrounding skin surface. A spark of 1/32 of an inch or less should be used as a rule. In this way the growth may be removed at one sitting, and ultimate scarring may be minimized. In my experience with this method of treatment in 812 cases, keloid developed in only two, and was then readily controlled by roentgen rays. But it would not seem advisable to employ electrodesiccation in patients with a tendency to keloid formation.

Rosacea is hard to cure, and it cannot be treated successfully unless the patient's general health is thoroughly investigated and corrected. I have seen cases that resisted all treatment until an infected gall bladder was drained, and others which improved after sinus infection had been attended to. The diet must be observed as strictly as in acne vulgaris, sugars, fats, and also very hot, irritant and spicy foods and drinks being avoided constantly. Roentgen therapy, in fractional doses, often seems to cause a discouraging temporary exacerbation of the rosacea, which subsides toward the end of the course. Of 83 patients finishing a course of treatment, 71 or 85.5 per cent, were cured, an average of 13 quarter-unit exposures being required. Continued care is required to prevent a recurrence.

Psoriasis, recurring perennially as it usually does, may often tax the therapeutic versatility of the most ingenious. Fortunately, many cases respond well to treatment with direct sunlight, either natural or artificial, and such treatment may be repeated ad libitum with a fair degree of safety. Occasionally, however, an acute outbreak may be aggravated by ultraviolet exposures, and therefore it is advisable that the effect of this treatment be tried first over small areas. Also of course there are some cases which absolutely fail to respond. Ointments, autogenous serum and other measures are often of value, and also arsenic, which, on account of its potential late dangers, should be withheld for cautious use as a last resource.

Warts of all types may be removed by means of electrodesiccation, and if care is exercised the resulting scar should be negligible. A very fine needle should be used, and the tip of the needle should not penetrate deeper than the level of the surrounding skin surface. The rough warts that occur on the fingers and especially about the finger nails, and the warts appearing on men's chins and women's necks respond well to this treatment. Venereal warts also respond favorably. In dealing with plantar warts, however, it is often necessary to go in so deep that the process of healing is protracted. Therefore, when confronted with a plantar wart I usually pare it down as thin as possible with the curet, and administer 2½ or 3 units of unfiltered roentgen rays, limited strictly to the wart itself. In my experience with plantar warts, 50 per cent have yielded to such treatment. If the wart does not disappear in six weeks, electrodesiccation may be used as a method of last resort.

Moles which are elevated above the skin surface may be removed by electrodesiccation. Those which are flat, like freckles, had better be left alone in order to avoid undesirable pitting. This method of treatment is rapid, usually removing the mole at one sitting, and the resultant scar is usually slight, if the technic is correct. The rough warty moles may recur after electrodesiccation, and excision may be necessary. If the mole is hairy, any hairs which have not been removed permanently by electrodesiccation may be destroyed later by electrolysis. Capillary or spider nevi may be destroyed by electrodesiccation or electrolysis, and even cavernous angiomas may be desiccated effectively. The jet-black or blue-black mole must be treated with respect, and had better be excised very wide and deep or let alone entirely. So-called senile angiomas, which are seen so commonly on the lips of elderly persons, can be destroyed readily by electrodesiccation. Xanthelasma, the small yellow tumors of the eyelids, may be removed quickly and completely by this means.

Sluggish ulcers, especially those accompanying varicose veins, are often stimulated to heal by ultraviolet, which probably serves as a local irritant to increase the circulation. But other measures, such as elevation, must not be neglected if we would obtain good results.

The course of pityriasis rosea usually may be shortened a week or two by an erythema dose of ultraviolet, or by a small amount of fractional roentgen irradiation, and the latter is particularly helpful for the relief of itching.

Electrolysis remains the only safe method for the permanent removal of superfluous hair. With careful technic, scarring will be slight or absent, and only about 10 per cent of the hairs will be likely to regrow.

Bactericidal Action of Ultraviolet Irradiation. Abst. in Jour. A. M. A., 99:19:1632, Nov. 5, 1932, from Am. Rev. Tuberc., 26:105, August, 1932.

Mayer and Dworski report that a suspension of tubercle bacilli, containing 2,750,000 organisms per cubic centimeter, was killed within four minutes by the absorption of the energy derived from the complete ultraviolet band of a mercury-quartz arc (Kromayer). A like amount of energy destroyed dried tubercle bacilli on the same suspension within four minutes. Tubercle bacilli, fixed by heat and then irradiated for from five to twenty-five minutes, showed changes indicative of disintegration, and irregularities were observed in staining by the Ziehl-Neelsen method.

Photosensitization. Harold F. Blum, Ph. D., Berkeley, California, in Annals Int. Med., vi:7:877, January, 1933.

There are phenomena in a considerable number which are produced in living systems by substances not normally present in these systems which sensitize them to

light. These phenomena are described collectively under the term photodynamic action; they are of widespread occurrence and manifest themselves in various ways. As examples may be cited: the hemolysis of red cells and the destruction of bacteria by light and eosin, and the poisoning of domestic animals by substances ingested from buckwheat. As has been pointed out by Blum (1932), these phenomena are apparently based upon similar chemical reactions, since, so far as they have been studied, all require the presence of molecular oxygen. This separates them at once from a number of similar phenomena produced by ultra-violet light without sensitizers, which take place in either the presence or absence of oxygen. It will be the purpose of the present communication to consider the possible relationship of such mechanisms to clinical medicine.

We will consider first the relationship of such mechanisms to certain disease entities, known principally to the dermatologist, which may be classed under the term "light sensitivity." Diseases falling under this head which have been suggested as due to photodynamic sensitization are Hydroa aestivale seu vacciniforme, Xeroderma pigmentosum, Eczema solare, and others. Hydroa, at least, has been widely accepted as a photodynamic phenomenon in which hematoporphyrin acts as the sensitizer. I shall not attempt to discuss any of these diseases from a symptomatic standpoint, but only to consider the possibility of abnormal photosensitizers as etiological factors in such conditions.

In the human organism there are present certain mechanisms which are stimulated by light. We may assume that the light is absorbed by certain photoactive substances which initiate these reactions, and thus the reactions are produced only by light of definite wave lengths which are absorbed by this substance. The activating radiations must all lie within the absorption spectrum of the photoactive substance, although all the wave lengths absorbed need not produce the photochemical reaction. The mechanisms of this type which are definitely known in the normal human body are: (a) pigmentation of the skin, (b) erythema, and (c) the calcium-phosphorus balance. The wave lengths bringing about these reactions are all in the ultraviolet region, below about 350 millimicrons. These reactions may be quite complex in their nature; the calcium-phosphorus balance mechanism is probably due to chemical changes brought about in ergosterol or similar substances circulating in the blood, but the other mechanisms are not so simply explainable. Now it is possible that an upset at any point in one of these mechanisms might result in a hypersensitivity of the organism to light, expressed in terms of that mechanism. Thus, for example, it may be that Xeroderma pigmentosum is due to an upset in some part of the pigment forming mechanism which does not involve the primary photochemical reaction in any way. In such case the light sensitivity would be brought about by the same rays which bring about the normal pigmentation reaction in the organism.

Photosensitization by ingested substances which enter the blood stream occurs in domestic animals. At least two well established instances are the conditions of fagopirismus and hypericismus which develop when animals are fed upon buckwheat or St. Johnswort respectively. No examples of such sensitization by foods are known in man although the possibility exists. Buckwheat poisoning has been described (Smith 1909) but this was undoubtedly allergy and not photosensitization.

Various instances of photosensitization as the result of the therapeutic use of photoactive substances in the clinic have occurred. The substances have sometimes been given by mouth, sometimes by intravenous or subcutaneous injection and sometimes applied to the skin. The earliest example is that of Prime (Hausmann, 1923, p. 156) who attempted to treat twenty-six epileptic patients with the bromin containing compound eosin. His patients developed a dermatitis and showed damage to the nails, particularly the thumbnail, which was most exposed to light. Jausion and Marceron (1925) observed sunstroke ("coup de soleil") in nine of twenty soldiers treated with trypaflavine for gonorrhea; dermatitis and excessive pigmentation were described by other observers using various acridine preparations (Hausmann and Haxthausen, 1929, p. 79-80). Numerous instances of sensitization by acridine compounds have been described for workers using this substance, or substances containing it, in technical procedures. The writer has recently been informed of a case in which rose-bengale had been used in liver function test, in which obstruction was present so that the dye was retained and the patient was photosensitive for a short time.

Dermatitis produced by substances applied to the skin have been described as photosensitizations (see Hausmann and Haxthausen, 1929), some of which may fall under this group. The toilet water or "Berlock" dermatitis which has been frequently described within the last few years is probably not a photodynamic effect.

It is probably safe to predict that more cases of phososensitization will soon be described, as the use of sensitizing substances in light therapy is being taken up to a certain extent. The use of photosensitizers (erythrosin) in light therapy was tried out in Finsen's Institute shortly after 1900 and subsequently abandoned. It was also tried out by Jesionek and Tappeiner (1905) in the treatment of superficial carcinoma with no definite results. Recently the use of sensitizers as a therapeutic measure has again been taken up. Gyorgi and Gottlieb (1923) claimed to have obtained good results in the treatment of rickets, and Macht and Anderson (1928) for the treatment of pernicious anemia using eosin as a sensitizer. Others have apparently applied the treatment to any condition which had at any time been treated by ultraviolet light; the sensitizers used include trypaflavine, and methylene blue as well as fluorescein dyes such as eosin and erythrosin.

I do not wish to deny the results claimed by these workers, but only to point out certain dangers which present themselves from a more or less theoretical viewpoint. Sensitizers of the type used are all known to produce damage to living cells by oxidative processes involving molecular oxygen. Other photochemical reactions of the sensitizers may be produced in organic or inorganic systems, e. g., the sensitization of the photographic plate, but such have never been demonstrated in living tissues.

The dangers arising from the use of sensitizers in therapeutics cannot be too strongly emphasized. If such methods are applied they should at least be used with great caution. It should be remembered that Meyer-Betz (1913) remained sensitive to light for several months after a single injection of hematoporphyrin and that lasting damage can be done by the incautious use of such methods.

Suberythema Method in Ultraviolet Irradiation. Abst. in Jour. A. M. A., 99:19:1637, Nov. 5, 1932, from New York State J. Med., New York, 32:951, Aug. 15, 1932.

Echtman aims to impress on those who employ the mercury quartz lamp as a therapeutic modality that burning of the skin is dangerous; that death lurks in the erythema, which is totally unnecessary in the treat-

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ment of diseases in which general body irradiation is considered of benefit. Cases are cited showing that patients with apparently poor prognosis were treated by ultraviolet irradiation, the erythema being avoided entirely, with desirable results. The author calls this form of irradiation the suberythema method.

Light Susceptibility and Rickets. Abst. in Jour. A. M. A., 99:20:1734, Nov. 12, 1932, from Jahrb. f. Kinderh., Berlin, 136:346, September, 1932.

Huldschinsky points out that the observation that dark races are especially susceptible to rickets when transplanted to a more moderate climate, whereas they are comparatively free from it in their native countries, speaks for an involvement of the skin in the pathogenesis of this disease, and he made tests to determine whether the light susceptibility of the skin is a factor in the pathogenesis of rickets. Theoretical reasoning indicates that such children are more susceptible to rickets whose skin does not readily react to the influence of light. The author tested the intensity of erythema developing under exposure to ultraviolet rays in children with and without rickets but obtained no evidence that a reduced sensitivity of the skin to ultraviolet radiation is a factor in the pathogenesis of rickets. On the contrary, some of the rachitic children were more sensitive than the nonrachitic children.

The Prevention of Rickets. F. Thomas Mitchell, M. D., and Stephen W. Coley, M. D., Memphis, Tennessee, in Jour. A. M. A., 99:21:1768, Nov. 19, 1932.

INFLUENCE OF LIGHT THERAPY

For many years the value of sunlight, or, as a substitute, the ultraviolet ray, has been recognized. Recent observations have confirmed this opinion, and Peyer places sunlight first in his list of the four antirachitic agents: sunlight, ultraviolet ray, cod liver oil and viosterol, as does Levine, after a study undertaken to evaluate the methods of increasing the blood calcium to a normal level. The amount of time spent in the sunshine has been recorded and tabulated. For this treatment the baby was stripped, except for the diaper, and placed in the sun for graduated periods of from five minutes to one hour a day as the tolerance of the skin increased. The time of exposure was gradually advanced as the season became warmer, so that the heat of the midday summer was avoided. In our climate, sunbaths may begin in May and be continued with almost uninterrupted regularity until late in September. For all the children in this series sunlight was advised, and in 33 children this treatment was carried out in what was believed by us to be sufficient dosage and with sufficient regularity. Of this number 3, or 9.9 per cent, developed rickets, which is the lowest prevalence noted in any part of this series studied.

Gerstenberger and Hartman and, more lately, Vollmer have determined the minimal amount of ultraviolet rays necessary as a preventive. In our series, 22 children received at least this amount, and only 3, or 13.6 per cent, of them fell into the rachitic class. From this we determine that the best antirachitic agent at hand today is a sufficient amount of direct sunlight, and that the ultraviolet rays are an entirely satisfactory substitute in the winter months. Since this group was evenly divided both as to numbers and results between those receiving cod liver oil and those receiving viosterol, no discussion of a combination of these agents is possible.

CONCLUSIONS

1. Either cod liver oil, in doses of 2 or 3 teaspoonfuls daily, or viosterol, in doses of 8 or 10 drops daily, exert a definite influence against the development of rickets, and by either treatment severe or even moderately marked rickets is prevented in babies who live in good hygienic surroundings.

2. In spite of the aforementioned therapy, 22.3 per cent of patients show clinically mild rickets. In 13.9 per cent of the cases, the roentgen findings were positive.

3. The administration of cod liver oil in the dosage mentioned completely protects 82 per cent of the patients, while the given dose of viosterol completely protects only 75 per cent in spite of the fact that the amount of viosterol has a little more than twice the amount of vitamin D contained in the daily dose of cod liver oil.

4. The lowest prevalence of rickets, 9.9 per cent, occurred among those given sunbaths in summer and viosterol or cod liver oil in winter. The ultraviolet ray is a satisfactory substitute for sunbaths, the incidence of rickets in those so treated being 13.6 per cent.

5. In the causation of rickets there must be other factors than a deficiency of vitamin D—a comparative deficiency of vitamin A, as expressed by De Sanctis and Craig, a deficiency of minerals in the diet as suggested by Weston, or perhaps some other as yet unrecognized agent in which the influence of light possibly plays as important a part as it does in the activation of ergosterol.

Irradiated Milk: The Influence of the Intensity and Character of the Radiations on the Anti-Rachitic Potency. G. C. Supplee (from the Research Laboratories of the Dry Milk Company, Bainbridge, New York) and H. H. Beck and M. J. Dorcas (from the National Carbon Company, Cleveland); The Jour. Biol. Chem., xcviii:2:769, November, 1932.

SUMMARY AND CONCLUSIONS

The total radiations from unscreened sources used in these experiments produced a higher antirachitic potency in the milk than the filtered radiations. The filtered radiations reduced the total energy applied per unit of time and caused a commensurate reduction in the antirachitic potency of the milk.

A definite intensity of radiation within the antirachitic range is necessary for the effective and efficient utilization of energy for the antirachitic activation of milk.

The progressive increase in the antirachitic potency of milk during irradiation follows definite principles within certain limits of applied energy irrespective of the source of radiation used. The rate of development of the antirachitic potency within these limits is, however, influenced by the qualitative character and intensity of the energy applied.

Treatment of Chorea by Baths. W. S. C. Copeman, M. A., M. B., M. R. C. P., Physician, British Red Cross Society's Clinic for Rheumatism, Peto Place; Assistant Physician Hospital of St. John and St. Elizabeth; British M. J., No. 3753, page 1054, Dec. 10, 1932.

A series of cases of chorea in children under fifteen, numbering forty-four in all, has been treated in the wards of the Cheyne Hospital for Children, Chelsea, since August, 1929, by means of reclining baths at skin temperature for considerable periods of immersion.

The patients were placed in the ward baths for a period of one to one and a half hours, in the morning and again in the afternoon. The bath was filled with tap water at skin (neutral) temperature, and kept at this point by partial refilling at intervals. The ward possessed only two baths, and as several cases were always under this treatment baths were given in rotation; any child whose treatment coincided with meal-time was fed in the bath. Each child had an air-ring placed around his neck which enabled him to lie back in the bath and

relax without fear of his head becoming submerged. In bad cases, when this danger would still be present, a canvas cover was fitted over the bath, and the head emerged through a hole. Subsequent to the bath the child was put to bed for an hour, after which light skin massage (sedative) was given to the limbs and back for twenty minutes. Children with heart disease were also treated in this way, but were conveyed on a trolley, and lifted in and out of the bath.

The sedative effect, which it is the object of this method of treatment to produce, was generally manifest after about a week of treatment. The effect of individual baths on the pulse rate was somewhat variable. If the pulse rate was initially over 100 a slowing effect of eight to ten beats per minute was practically invariable by the end of the bath. With lower rates the most usual effect was a decrease in frequency of four to eight beats. Occasionally this was only manifest after one of the two daily baths in which case it was always after the afternoon bath. It was noticed in several of the original cases that the pulse rate increased after baths. This was investigated more fully, and it appeared likely that it was due (a) to the child playing while not observed, or (b) turning on the hot tap while unobserved; an increase in the pulse rate was only noticed on very few occasions after closer observation was instituted.

In practically every case the child became very fond of the treatment. During the first four or five days slight cyanosis, shivering, or looseness of the bowels was observed after the bath in a few cases, but this passed off and did not recur except in one case, when looseness of the bowels persisted for three weeks. The cyanosis occurred chiefly in the cardiac cases. All these patients were kept on the treatment, however, and ultimately did well.

SUMMARY

Forty-four cases of chorea of long standing, referred mostly from general hospitals, were treated without drugs but by means of somewhat prolonged immersion in baths at "neutral" temperatures, and general (light) massage. A small control series was treated on orthodox lines. It was found that the same result was ultimately achieved in both groups. The bath group took longer, but the ultimate incidence of relapses proved lower than in the orthodox group. It is probable that a combination of the method described with ordinary drug therapy would prove a more successful measure than either separately. This could easily be adopted in hospital, since no special apparatus—other than an ordinary air ring or canvas bath-top cover to fit the ward bath—is necessary.

Accidental Injuries in Office Practice. Richard Kovacs, M.D., New York, in Jour. A. M. A., 100:2:107, Jan. 14, 1933.

The causes that lead to the occurrence of accidental injuries can be classified in three broad groups: (1) the equation of the operator—improper technic or inattention; (2) the equation of the patient—unusual sensitiveness (or idiosyncrasy, which is particularly true in regard to x-rays), lack of cooperation or contributory negligence; (3) the equation of apparatus and accessories—faulty construction or mechanical breakdown. Many injuries are attributable to an unfortunate combination of causes. Considering the widespread use of physical treatment measures, the number of injuries occurring is almost negligible; as long as the general rules of safe technic are followed, a single cause usually does not lead to any serious injury.

Accidental injuries in the course of office treatment by physical measures can be grouped as follows: 1. Electrical shock, due to the sudden powerful influence of an electric current on the entire body; this may be due to (a) accidental contact with a grounded object (water pipe, radiator, electrical socket) while receiving an electric current from an apparatus or while receiving a galvanic bath; (b) breakdown between the primary and secondary side of a high tension transformer and lack of sufficient safeguards (magnetic cutout) to prevent the jumping over of the dangerous high tension low frequency current to the patient. 2. Burns of varying kind, due either to excessive heat or ultraviolet radiation over part of the body. Inflammation of the eyes has occurred through neglect of protecting the eyes against ultraviolet rays. 3. Mechanical injuries, tearing of the skin or rupture of internal organs, due to a blow from an improperly supported piece of apparatus or to excessive action of the apparatus itself, as has happened with some mechanical exercisers.

EQUATION OF THE OPERATOR

The operator of any piece of apparatus used for diagnosis and treatment must have a fair conception of its working mechanism and have full knowledge of the proper technic of its application.

Burns due to heat treatment by lamps as a rule also show up immediately, but occasionally a blister may develop over night, following a long heat exposure.

A final point of safe technic is never to leave a patient alone during a treatment in which the slipping of a conducting cord or a fastening clip or of any of the electrodes could give rise to an immediate burn.

EQUATION OF THE PATIENT

The physical and mental equation of the patient is of paramount importance in administering treatments.

As is well known, in diathermy and galvanic treatments the theoretical amount of current intensity is estimated according to the size of the active electrode—provided the electrodes are equidistant and on opposite surfaces of the body. The meter reading on the apparatus, however, mainly serves as a safeguard as to the maximum amount that may be administered.

EQUATION OF THE APPARATUS

Apparatus must be in good working order as an essential for the safe application of any kind of treatment. At the same time, any apparatus used day by day is apt to get out of order through continued friction or wear, such as slow disintegration of insulation due to heat, or through defective construction. When a patient is treated by an apparatus with an undetected defect, a minor mishap or a real tragedy may occur. Kowarschik recently reported two such happenings. In one case galvanic treatment for facial paralysis was administered from a new type of vacuum tube galvanic generator, which changes the alternating street current into a direct or galvanic current. One electrode in the form of a half mask was placed over the face, the other over the forearm. A small, cheap circular wire rheostat, similar to the control on radio boards, was used to regulate the strength of the current. At the end of the treatment the assistant slowly turned this control back to zero, and just at that moment the patient cried aloud and fell unconscious to the floor as if struck by an electric bolt. The cause for the profound electrical shock was found in the poor construction of the rheostat, the lever of which swung over from the zero position to 360 degrees—that of full strength—without an intervening catch. The patient thus suddenly received the full strength of the current through the head.

The other, more tragic, case was that of an Italian

physician who demonstrated to a group of friends the mild heat effects of a high frequency current by making each hold two cylindric metal electrodes and turning on the current. When the turn of a girl, aged 19 years, came, and the current was put on in the same manner, she fell dead. It was found that a broken wire in the transformer caused the dangerous high voltage low frequency current to jump over in to the high frequency circuit, there being, contrary to the safe rule, direct (galvanic) coupling between the two sides instead of the safe inductive or magnetic coupling. In the use of x-ray apparatus there have been several fatal accidents to patients, physicians or nurses, or to a person holding a child in position on an x-ray table. A form of public liability insurance should be carried by physicians to cover such accidents.

SUMMARY

Only the principal factors in causing accidental injuries have been outlined, and no effort has been made to describe these injuries or their treatment in detail. It is evident that any form of office treatment by apparatus that is powerful enough to do good is capable of causing various degrees of injury through improper technic, contributory negligence of the patient, or mechanical faults in the apparatus or accessories. General practitioner and specialist alike must be acceptably trained and be ever watchful to administer treatments within a large margin of safety so that, whatever accident may occur from time to time, it will belong among the really unavoidable ones.

Electric Current and Electrical Medical Apparatus. Sec. of Current Comment, Abst. in Jour. A. M. A., 99:20:1694, Nov. 12, 1932.

As most people know, the common lighting circuit is of the alternating current type with a 60-cycle frequency. Throughout western Michigan, until recently, the frequency of the current furnished by the Consumers Power Company, which distributes electric energy in that region, has been 30 cycle. When it was decided to change the current frequency to conform to the common standard, the matter became important to physicians who use electrical therapeutic equipment. The Consumers Power Company offered to rebuild in its own shops any apparatus—domestic, commercial or otherwise—that necessitated a change of construction to meet the requirements brought about by the change of frequency. Some manufacturers of electrical therapeutic apparatus should be made by themselves, while others went so far as to oppose any rebuilding and recommended the purchase of new equipment. The extent, however, of the frequency change project in western Michigan, which included rebuilding the entire utilization system of such cities as Grand Rapids, Muskegon, Cadillac and Manistee, made it economically possible for the power company to assemble skilled personnel and adequate shop facilities for changing not only commercial equipment but also therapeutic equipment to the equivalent 60-cycle operation. One manufacturer of mercury vapor arc air-cooled quartz lamps had declared that, unless certain expensive replacements were made, the radiation from a 30-cycle lamp, when connected with a 60-cycle current, would be reduced one third. It was found, however, that a 30-cycle lamp could be operated on the 60-cycle current without any change whatever and, in fact, give an output that was equal to, or slightly greater than, that given on 30 cycles, while its power consumption was less than on the lower frequency. Another interesting investigation concerned the electrical characteristics of diathermy machines. One maker of diathermy apparatus asserted that machines rebuilt by the utility company had become unbalanced, as indicated by a sparking and pricking sensation when a patient was touched by any one during treatment. It was said that this condition was caused by failure of the power company to use new 60-cycle transformers supplied by the manufacturer. The results of this investigation and of others are too technical to describe, but the details are available. The power company demonstrated conclusively to the manufacturer that the diathermy machines could be made to operate as well on 60-cycle as on 30-cycle current, if not better. The results of both investigations were later confirmed by Dr. Albert Bachem, professor of biophysics at the University of Illinois. The incident is a fine example of the way in which new inventions or modifications, by their far-reaching effects, complicate the nature of medical practice.

Electrical Accidents. Abst. in Jour. A. M. A., 99:20:1730, Nov. 12, 1932, from Jour. of State Med., London, 40:459 (Aug.) 1932.

Critchley gives the following instructions for the immediate treatment of electrical shock: Release the victim but avoid sustaining a shock oneself. Any dry nonconductor may be used to move the victim or the live conductor. If both the victim's hands are grasping the live conductor, free them one at a time. If necessary, shut off the current. The nearest switch should be opened. If it is necessary to cut a live wire, use a wooden-handled ax, turning away the face to avoid the flash. Put a finger in the victim's mouth to remove teeth, gum or tobacco. Lay the patient on the abdomen, one arm extended upward, and other elbow flexed. Rest the face on the hand so that the mouth and nose are free. Carry out artificial respiration, according to Schafer's method, for at least three and a half hours. When the patient revives, keep him lying down. Keep him warm. Watch the respiration carefully lest it fail again.

A Means of Applying Diathermy to Irregular Surfaces of the Body and Inside the Mouth. By C. Bowdler Henry, L.R.C.P., M.R.C.S., L.D.S. (Eng.). Dental Surgeon to the Royal Dental Hospital, Late Surgeon-Dentist to the Westminster Hospital, in Brit. J. Radiol., V:59:807, Nov. 1932.

THE EXTERNAL ELECTRODE

The electrode for external use consists of a rigid insulated sheet of vulcanite or bakelite roughly moulded to form a casing over the area to be treated. It is held in place by means of rubber bands attached to studs embedded in the material in suitable places. The base is totally lined on the tissue side with metal foil, which is connected to an external terminal. When required for use, the metal surface of the electrode is thickly coated with Diatol I, a plastic conducting material.

THE INTRA-ORAL ELECTRODE

The necessity for the application of diathermy inside the mouth has been appreciated for a long time, but the difficulty has been to make an electrode which would fit so irregular a surface. The first intra-oral electrode was designed by me in 1925 and consisted of a vulcanite plate (like an artificial denture plate) lined with tin foil over that part of the tissues which it was desired to treat. The tin lining was connected by means of a wire passing through a vulcanite stem to a terminal outside the mouth. Provision was made on the lingual surface of the electrode for pressure from the opposing jaw, and the patient kept the electrode in place by biting on it.

Electrodes of this pattern work very satisfactorily. The only objection is the expense, for in each case it

is necessary to take impressions of the mouth and to make plaster casts as for artificial dentures.

The shock electrode consists of a vulcanite blank of similar shape, but the metail foil lines it all over. It is necessary, therefore, if only a part of the mouth is to be treated, to block off with insulating material that portion overlying the part where treatment is not required, before filling with Diatol. Ordinary Stent's dental composition, which is insulating, is softened in hot water and pressed into the electrode. While the composition is still soft, the electrode is placed in the mouth and pressed into position. The composition is allowed to cool, and when the electrode is withdrawn an impression of the mouth is found. The portion of the alveolar ridge to receive treatment is marked out on the composition, which is then cut away until the metal lining of the electrode is exposed.

The field of the intra-oral diathermy chiefly consists of cases of residual infection of the jaws. This type of chronic infection, the legacy of septic teeth, may persist for ten or even twenty years after the removal of the teeth, even when the patient is edentulous. In some patients it causes severe and persistent neuralgia of the trigeminal type, in others, various remote lesions as the result of focal toxaemia, and in all of these, a rarefying osteitis of the jaws. The field of diathermy also includes cases of periodontal infection undergoing conservative treatment. All these cases derive great benefit from the deep hyperaemia which can be produced in the mouth by diathermy as by no other method, and when this treatment is used in conjunction with the administration of an autogenous vaccine the results may be startling.

Present Status of Diathermy in Ophthalmology. Grover H. Poos, M. D., F. A. C. S., Saint Louis, in Am. J. Ophthalmol., 15:12:1150, December, 1932.

Authorities have not heralded diathermy as a panacea but rather as an adjunct to other recognized therapeutic or surgical methods.

Gala found that surgical diathermy yielded excellent therapeutic and cosmetic results in the treatment of carcinoma of the lids and the surrounding area. If the tissues are adequately coagulated there is no fear of recurrence. It is the method of choice in otherwise inoperable cancer.

Zubak has successfully removed, under the influence of butyn anesthesia, seven pterygia by a two-step electrocoagulation. The pterygium is grasped by a fixation forceps at its broadest expanse and raised from the globe. In the first step, the needle is inserted just enough to coagulate the inferior margin, the superior margin, and at times the middle portion, after which the head and neck turn a distinct white. A week later the head and neck will have sloughed off, after which the remaining remnants will be coagulated. The author concludes that this method is superior to surgical measures because it is safer, due to the sterilizing qualities of the current, and more rapid and economical in that there is no preparation or loss of time.

Larsson describes his treatment of retinal detachment with electroendothermy and trephining. The operation consists in lifting the conjunctiva to give an exposure of the sclera over the detached area, tenotomizing one or more of the ocular muscles if necessary, after which surgical diathermy is applied over the exposed sclera. One or two trephine openings are made with an Elliot trephine to allow an outlet for the subretinal fluid and prevent a rise in intraocular pressure from the postoperative reaction. All hemorrhages are controlled by electrocoagulation. Seven cases were operated on with this technic with good results. The reattachment probably occurs by setting up an adhesive choroiditis and lessening the secretion of the chorio-capillaris because of atrophy of the cicatrized choroid.

I have found by experience that medical and surgical diathermy are of value in the treatment of blepharitis and neuroparalytic keratitis. I have accepted medical diathermy as a valuable adjunct in the treatment of chronic conjunctivitis, atonic keratitis, iritis, and incipient cataract. A resume of a single case of iritis and one of incipient cataract will give my experience with this form of therapy.

Mrs. C. K., aged fifty-eight years, consulted me on March 2, 1931, with the typical complaint and appearance of iritis of the left eye. A history of three days duration was given. At this time her vision in the right eye with glasses equalled 20/19, while vision in the left eye with glasses equalled 20/60. The accepted medical treatment was instituted, and a search for the etiology was made at the hospital, however, without any definite conclusions.

On March 14th medical diathermy was used in conjunction with the previous treatment. This consisted first of daily and later weekly treatments. The amperage and duration of the treatment was regulated according to the patient's comfort. This dosage was increased until 500 milliamperes for thirty minutes was taken. The relief of pain and the absorption of exudates could well be attributed to the diathermy. On April 30th the left eye was entirely quiet with no injection, the iria and pupil being clear and the exudate absorbed. Refraction a month later was found to be: right eye with +1.00 D. sph. ⌔ +1.00 D. cyl. ax. 50° vision equally 20/19; and the left eye, with +0.75 D. sph. ⌔ +0.75 D. cyl. ax. 110° vision equalled 20/19. A+2.50 D. sph. was added for reading.

Mr. L. K. A., aged thirty-eight years, came to me on March 19, 1931, complaining of blurred vision and spots before the eyes. His vision was 20/30 in the right eye, and with a +0.25 D. sph. ⌔ +0.25 D. cyl. ax. 15° vision equalled 20/24; while with the left eye vision was 20/19, with a +0.25 D. sph. ⌔ +0.25 D. cyl. ax. 125° vision equalled 20/15-2. After dilatation of the pupils the ophthalmoscope showed both fundi normal, but in the right lens appeared various striae. Instillations of dionin and later Week's mixture were continued until September 24, when his vision in the right eye had declined to 20/96, while the vision in the left eye remained 20/19. A physical and laboratory examination at the hospital was negative except for a low metabolism. Medical diathermy by means of the Hollender and Cottle headband and the smaller electrode, with tin foil interposed, was applied to the right eye while the larger electrode was applied to the neck. Treatments were given at intervals of once a week, or a total of nine treatments, and the dosage as well as the length of time were regulated according to the patient's tolerance. On December 20, 1931, the vision of each eye was normal with no evidence of lens change. The vision of each eye on April 18, 1932, was 20/19 and the lens was clear.

In our investigation, surgical diathermy has been limited to diseases of the eyelids and surrounding tissue. Warts, moles, xanthomata, and chalazia have been successfully removed. Chalazia was first treated by incision and evacuation of the contents, followed by destruction of the lining membrane with desiccation. Certain cases of entropion yield to a mild coagulating current. The skin and subcutaneous tissues of the lid are punctured several times with a cambric needle electrode.

This produces a scar contracture after healing and as a result draws the lid margin outward.

Desiccation with the needle point electrode applied to the surface of trachoma granules, especially in chronic cases, has been encouraging. Only a few granules should be treated at one time since the production of a reaction causes the patient to be uncomfortable for several days.

Malignancy, involving or adjacent to the inner or outer canthus, requires early complete destruction. Mr. Wm. E., aged sixty-four years, had a macroscopic epithelioma located 1 mm. external to the right outer canthus. This was thoroughly desiccated and it healed within two weeks. There has been no recurrence after ten months' observation.

German and British authorities have written more about medical diathermy, while French and American writers have given more attention to surgical diathermy. No authority, however, would herald diathermy as a cure-all but rather as an adjunct to other recognized therapeutic or surgical methods. Arousing great interest among the medical profession everywhere, both medical and surgical diathermy are destined to play a part in ophthalmology; and we shall watch with interest, and further as much as we consistently can, the sober study and discussion by which, only, its claims can be established or disproved.

Diathermy in the Treatment of General Paresis. Hugh A. McKay, M.B., Medical Supt., Ontario Hospital, Mimico, and Kenneth G. Gray, M.B., and William C. Winans, M.D., Assistant Physicians, Ontario Hospital, Mimico, in Am. J. Psychiatry, 12:3:831, November, 1932.

The treatment of general paresis by artificial fever has effected favorable results in the hands of many observers. The bibliography on this subject has swelled to considerable proportions, and the conclusions drawn have been uniformly favorable. Until 1930, writers have reported malaria almost exclusively as the therapeutic agent. During the years 1930 and 1931 an increasing number of investigators have been contributing results obtained by the use of high frequency currents, a method first reported by Neymann and Osborne in 1929.

The merits of diathermy will be tested when a large number of cases have been treated in several clinics. It is with this in mind that we add this group of cases to the relatively few on record at the present time.

The series presented in this paper comprises a total of 32 patients. Of this number, 28 have completed their course of treatment and it is with this group that we are chiefly concerned.

The results obtained in the group of 28 might be summarized as follows:

Three, or approximately 11 per cent, represent complete remissions; they are able to resume their former occupation outside the hospital.

Eight, or approximately 29 per cent, represent almost a complete remission; they have no physical defect, and no psychotic traits, nor outstanding mental defect; they are able to carry on trustworthy positions in hospital.

Seven, or 25 per cent, represent partial remission; they are able to carry on outside work in hospital under supervision. Three have physical defect and this limits their activity, one has a memory defect and one has considerable impairment of speech.

Seven, or 25 per cent, are unimproved, but are quieter, cleaner, cleaner in their habits and less trouble from a nursing standpoint.

Of the 28 treated cases, three have died. One death was due to an intercurrent erysipelas with pneumonia; he would have been classed as a remission. One death was attributed to a failure of heat regulation induced by diathermy and is discussed in detail below. One death was due to hemiplegia.

All patients receiving the treatment have shown a marked physical improvement such as gain in weight and strength.

All patients in this series showed before treatment a positive blood Wassermann, a positive spinal fluid Wassermann, and a typical colloidal gold and colloidal mastic reaction. On repeating these tests after a course of treatment there was found to be a change in the spinal fluid of nine patients. In six of these the colloidal gold and colloidal mastic reactions became normal but at the same time their Wassermann reaction remained unchanged. In one case, the blood Wassermann was negative and the spinal fluid Wassermann positive, with a normal colloidal gold reaction. The three remaining cases showed a favorable change in both the colloidal gold and colloidal mastic. Three of the cases with normal colloidal gold reactions were clinical remissions. In the other six cases the improvement in the serology did not parallel the clinical course.

It is to be noted that seven of the series of 28 had received malarial treatment previously without result. The malarial treatment was administered not more recently than two years.

The literature at present does not record any cases of death occurring under such circumstances that death might have been attributed to the therapy. The following case is that of a patient who developed hyperpyrexia while on the machine, followed shortly by death. An autopsy was performed.

With the opportunity to study a case of this type at autopsy, two major questions were of interest. Was the patient suffering from disease which of itself caused death or which might have rendered him more susceptible to the effects of diathermy. Secondly, what pathological effects of the treatment are revealed?

The data obtained both clinically and post mortem lead to the conclusion that the patient was not suffering from disease which of itself caused death. It seems likely that this individual represents a type which is susceptible to the elevation of temperature induced by diathermy. There is apparently no method of recognizing such cases in advance. From the reported cases, the incidence of this susceptible group must be small. The post mortem changes exhibited by this patient are those which might readily be induced by hyperpyrexia alone.

SUMMARY

A series of 32 patients treated by diathermy in conjunction with chemotherapy is presented. The clinical outcome of 28 completed cases is described.

The clinical course and post mortem findings of a case which died during treatment are outlined. Evidence that certain patients are susceptible to the elevation of temperature induced by diathermy is offered.

Treatment of Mental Disorders by Pyrexia Produced by Diathermy. Abst. in Jour. A. M. A., 99:20:1731, Nov. 12, 1932, from Lancet, London, 2:337 (Aug. 13) 1932.

Bamford enumerates thus the advantages of the treatment of mental disorders by pyrexia produced by diathermy:

1. The pyrexia is under complete control throughout the treatment. Application can be given at any time and to any number. 2. Prolonged treatment by this method does not produce physical prostration and weakness. 3. It is possible to give this mode of treatment to patients who are aged, marasmic, debilitated, or even affected with organic disease. Among the disadvantages

of this form of treatment are the following: 1. It can be administered with safety only to patients who are quiet, restful and cooperative. 2. The great danger of burns due to motor restlessness seriously restricts the scope of the method. 3. There is no evidence in the author's experience to show that it is any more effective in producing a clinical remission than malaria.

Sustained Artificial Fever in the Treatment of Intractable Asthma. Physiologic and Therapeutic Considerations. Samuel M. Feinberg, M.D., Strafford L. Osborne, B.P.E. and Meyer J. Steinberg, M.D., Chicago, in Jour. A.M.A., 99:10:801, Sept. 3, 1932.

Thorough heat insulation is a most essential factor in securing a satisfactory temperature curve. A method was previously described by us but has now been abandoned for a simpler and far more effective arrangement. None of our patients could lie down in bed but had to recline on a back rest in the sitting or semisitting position. This made it difficult to prevent loss of heat around the shoulders, particularly when the patient became restless, and so the thought occurred to one of us (S. M. F.) that a specially prepared heat insulating bag might better serve our purpose. Such a treatment bag, designed by us and made by a well known manufacturer of electrotherapeutic apparatus, is now used. The entire bag is waterproofed and so can be quite clean and sanitary. The patient is wrapped in two layers of bath blankets to absorb the perspiration, and the entire bag is closed by means of a hookless fastening arrangement (zipper type) with suitable openings for electrode leads and thermometer readings. Thus the patient is entirely enclosed with the shoulders and neck thoroughly insulated from loss of heat, no matter how restless he might become. The excessive laundry cost of the older method is reduced to an almost negligible factor by this arrangement. After use the bag can be washed without damage. Moreover, the patient is not burdened and exhausted by the weight of six heavy woolen blankets and rubber sheeting. The work of the nurse is also materially lightened.

Rectal temperature is the only safe guide. We use the thermocouple method of recording rectal temperature as this permits a minimum of disturbance to the patient and loss of heat due to getting into the treatment bag every fifteen minutes. The method and instrument used have previously been described by Markson and Osborne. The difficulty of maintaining the constant junction at a constant temperature presented certain disadvantages, chief of which was an incorrect temperature reading. The problem was presented to a well known scientific supply house, and they have developed for our use a similar instrument that is simple and accurate in operation. It is a sensitive indicating device, so that the temperature changes can be noted instantly. This advantage while working with high temperatures is obvious.

The care of electrodes is most important if burns are to be avoided. They must be rolled out on a flat surface, the metal free from rucks, and the rubber backing applied. The body is anointed with a lubricating jelly, and the back electrode is applied with the patient sitting up, care being taken to see that it does not extend too high at the shoulders. The canvas jacket is placed over this and the patient lies down in a position on the back rest. Then the front plate is applied but not molded to the chest by the hands. The jacket is then loosely laced down the center and is gradually tightened to a comfortable point. A gradual tightening of the side laces molds the electrodes to the body contours without digging the edges into the skin.

The amount and duration of current flow necessary to secure the desired temperature will differ with patients. We use from 3,000 to 6,000 milliamperes. Four thousand milliamperes was the general average. An hour and three-fourths was the average time necessary to secure and sustain a rectal temperature of 104 F., which it was our aim to secure and sustain for eight hours. This has been accomplished. At the end of this period insulation is gradually removed thus lowering the temperature. When the rectal temperature falls to 100 F., a tepid sponge bath is given and the patient placed in a freshly prepared bed.

After the current is turned off a secondary rise of temperature nearly always ensues and occasionally rises above 106 F. When the rectal temperature reaches 106 F. and a clinical thermometer is used for recording, readings should be taken every two minutes until it begins to fall. The temperature should not be permitted to exceed 106 F. rectally. At this temperature exposure of an arm is usually sufficient to prevent a further rise, and as soon as the temperature begins to drop the arm is covered again. Nurses are supplied with written instructions on methods of reducing temperature without detriment to the treatment. Occasionally the temperature will have a tendency to fall below the desired level before the eight hour period has elapsed. The use of hot water bags in the bed will often prevent this drop and may even cause the temperature to rise. Hot water bags should be removed when the rectal temperature reaches 105 F.

We have arbitrarily selected two treatments as a course and these are given at two or three day intervals. Lately we have given repeated courses of treatment to patients when they began to retrogress. These, however, have been given at no definite interval of time.

SUMMARY

This report concerns a group of forty-two patients with intractable asthma, 70 per cent of whom had complications such as emphysema, chronic bronchitis or bronchietasis, and all of whom had been unrelieved by the usual methods of treatment. Fever, produced by high frequency currents according to a described improved technic, was tried in all of these patients and was found to be a safe procedure. Of thirty-five of those in whom the results have been ascertained, 51 per cent had a complete remission varying from several days to nine and one-half months, and 29 per cent had improvement without remissions.

It is possible that with cases of milder degree and with more persistent treatment even better results may be obtained. The laboratory determinations and other observations do not as yet allow any conclusion as to the mechanism of this relief. It is suggested that fever therapy may possibly be found useful in other allergic conditions such as urticaria, angioneurotic edema, eczema, hay fever and migraine.

In conclusion, we may definitely state that in fever therapy we have found a method of obtaining relief in some cases of intractable asthma in which all other methods had heretofore failed.

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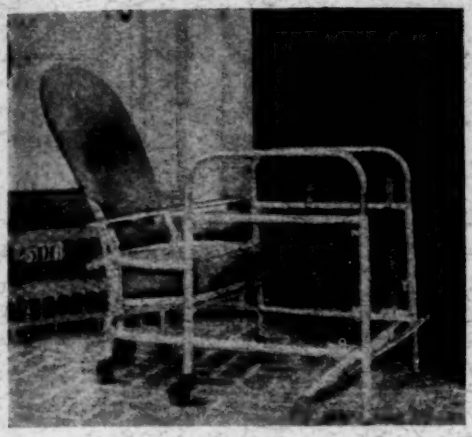

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